ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

APRIL 1959

PRICE ONE DOLLAR

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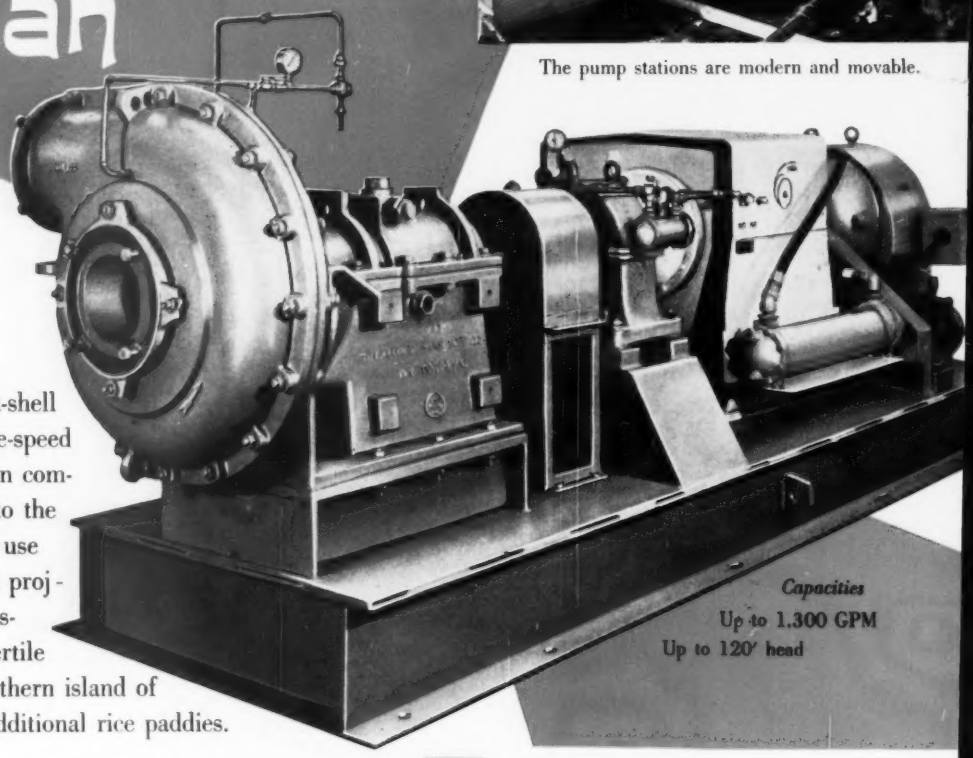
Channeling discharge for distribution.

The pump stations are modern and movable.

More rice for Japan



This Hydroseal split-shell slurry pump, with variable-speed accessories, is one of seven complete assemblies shipped to the Japanese Government for use in a vast land-reclamation project. Pump stations will distribute new soil over unfertile peat bogs to give the Northern island of Hokkaido much-needed additional rice paddies.

Capacities
Up to 1,300 GPM
Up to 120′ head

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HYDROSEAL *and* **CENTRISEAL**
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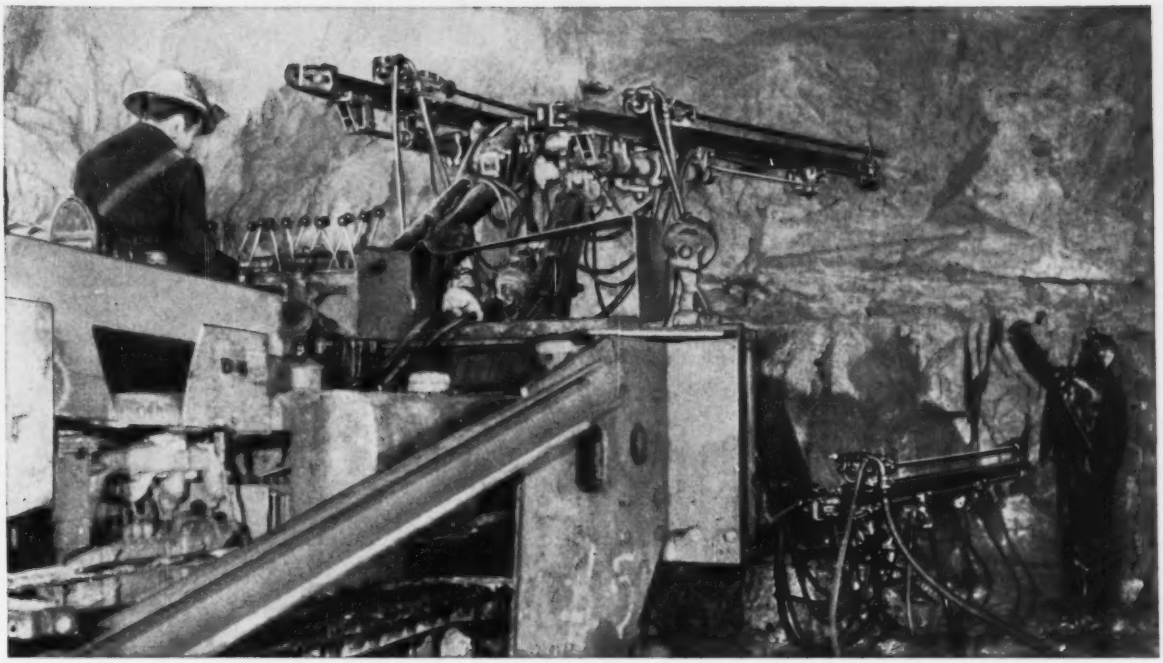
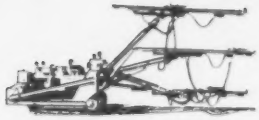
MAXIMIX RUBBER PROTECTED

HYDRA-BOOMS

speed underground drilling in Canada's URANIUM MINING BOOM





Unlike the gold rush of Klondike days, the uranium boom in Canada's Algoma Elliott Lake area is spearheaded by the most efficient *mechanized* equipment. To speed up drilling with minimum effort, the Panel Mine of Northspan Uranium Mines Ltd. is using four Ingersoll-Rand Hydra-Boom drilling rigs, one of which is shown above, operating 1700 feet below the surface.

Each tractor-mounted rig carries three heavy-duty I-R drifter drills mounted on Ingersoll-Rand Hydra-Booms, providing smooth effortless hydraulic control of all drill motions. Booms are raised or lowered and swung from side to side and drill guides are extended, retracted, dumped and swung at the touch of a throttle—all drills easily controlled by one rig operator. Using 1⅛″ round steel and 1¾″ tungsten carbide insert bits, these rigs are used in a room and pillar trackless mining operation, teamed with 48″ ramps mounting 30-hp I-R slusher hoists.

I-R Hydra-Booms represent the last word in *mechanized* rock drilling—convert setup time into drilling time and increase production by as much as two-to-one. Rugged, versatile and easy to operate, Hydra-Booms are designed and built to withstand the punishment and abuse inherent in underground mining operations. Swing and lift cylinders are double acting, fast moving, and locked to prevent dropping the boom if hydraulic lines are broken.

Ask your Ingersoll-Rand drilling engineer for complete, cost-saving facts about I-R Hydra-Booms. Or send for a copy of new bulletin 4196.

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HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

APRIL 1959

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World News Bureaus: London, Bonn, Paris, Rio de Janeiro, Mexico City, Beirut, Tokyo, Melbourne. **World News Offices:** Stockholm, Manila, Buenos Aires, Caracas, Havana, Lima, Santiago, Montreal, Toronto, Vancouver, Johannesburg.

Published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), founder. Publication Office: 3rd & Hunting Park Ave., Philadelphia 40, Pa. See panel below for directions regarding subscription or change of address.

Executive, Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, president; Joseph A. Gerardi, executive vice president; L. Keith Goodrich, vice president and treasurer; John J. Cooke, secretary. Offices of the publication Division: Nelson L. Bond, president; Harry L. Waddell, senior vice president; Ralph B. Smith, vice president and editorial director; Joseph H. Allen, vice president and director of advertising sales; A. R. Venezian, vice president and circulation coordinator.

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Subscription rates for individuals in the field of the publication: United States and possessions $4 a year; $6 for two years; single copy $1. Canada $5 a year; $8 for two years; single copy $1. Other Western Hemisphere and Phillippines $8 a year; $12 for two years; $16 for three years; single copy $1. Elsewhere $15 a year; $25 for two years; $30 for three years; single copy $2.

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SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, ENGINEERING & MINING JOURNAL, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any, if possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one or two issues in advance, please allow one month in sending notice for the change to become effective.

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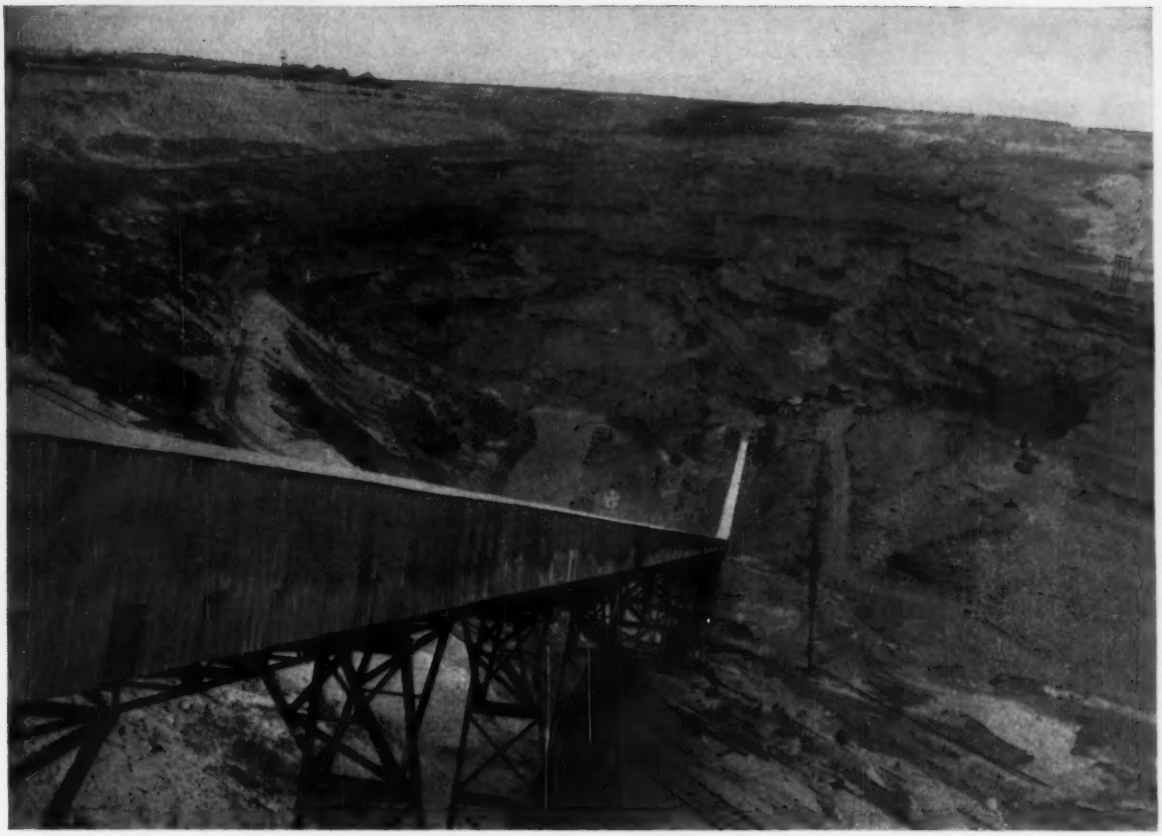
B.F.Goodrich



One belt does the work of 3 on high lift, long distance hauls

Oldest steel cord belt on Iron Range now in its 11th season

Problem: It's over a third of a mile and a 340-foot lift from the bottom of that iron ore mine up to railroad cars. Getting ore out of a deep pit like this used to take a series of three or more conveyor belts. No one belt could be strong enough for the job without being so heavy and stiff it would be impractical.

What was done: B.F.Goodrich engineers went to work on the problem, and developed steel cord construction. In this exclusive conveyor belt design, individual steel cords run lengthwise, each completely surrounded by rubber. These parallel cords give tremendous strength, yet are flexible so that troughing is natural, belt keeps centered on idlers, spillage is held to a minimum.

Savings: With steel cord construction, one conveyor belt now does the job of three or four belts on high lift, long distance installations. Money is saved, maintenance reduced, because the steel cord belt eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts.

Extra benefits: The B.F.Goodrich steel cord belt installed here has been at work 11 seasons now, hauling 1000 tons of ore an hour up and out of the pit. It has lasted longer than any conveyor belt ever made with steel cords or cables.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-568 Akron 18, Ohio.*

B.F.Goodrich *conveyor belts*

Behind the By-Lines...

We have always admired the heads-up attitude of the market research boys at Reynolds Metals Co., but right now our enthusiasm knows no bounds.

An announcement in late February signaled the imminent arrival of the greatest boon to human relations since Henry Ford invented the back seat.

Reynolds will market "a fully automatic aluminum container for home dispensing of draft beer . . . in case quantities." (There was some other mention of carbonated soft drinks and milk, but let's not go into any of that nonsense.)

If there was ever a testimonial to capitalistic free enterprise and its sensitivity to mankind's needs in a materialistic age, this is it.

With awesome inexorability, man as we know him has been deprived of his last great retreat: the quaffing of the amber in a cool, dark-paneled retreat, and the ministrations of a sympathetic barman.

First came all that imitation red leather and chrome; then came shrill feminine laughter; then came the awful concoctions they order; and then, oh death knell, came the juke box. The attentive and sympathetic dispenser of the hops has had his function expropriated by the psychiatrist and the revival leader. He now is a mere glass and bottle cap tender, with no relation to the immortal Hebe, bearer of the cups.

So man was driven back home. But it isn't the same. Interrupting conversation or close harmony to dash to the icebox for another bottle dispels the mood. There's altogether too much clink and clatter.

Now, Reynolds says the "Tapper", an invention of John H. Bull, of Chicago, will undergo market testing later in the year. We ought to have the paneling tacked up by then—and we plan to be the most responsive test subject they've encountered in many a survey.

If this issue winds up in a pretty tattered state after you've had it a few days, we'll be very pleased. That isn't a reflection on the efficiency of the machines in the printer's bindery, but a devout hope that you'll find the various articles worthy of distribution among the guys in the mill, the mine, the office and the maintenance shop.

For the mine: we recommend the findings of the Leipzig symposium on rock mechanics, a collection of information and ideas that represents the most recent developments in Western Europe, with an added fillip in the inclusion of some Russian data. p 106

There's more. Don't wait too long before checking the story on Rare Metal's San Mateo mine in Ambrosia Lake. The ore is plenty deep and the ground difficult. How San Mateo is tackling the problem makes for interesting reading. p 110

One of the best sources for kangaroos and mine operating stories is the continent of Australia. We don't have much trouble with our kangaroo supply. One kangaroo lasts quite a while in this climate. But the demand for good, clear and profitable mine technique stories is great, and we get ours in print as soon as possible. This month's contribution starts on p 104. Incidentally, the working title of the story seemed to bring out latent musical talents in the shop. But then, you should try talking about "the sand dam fill at Broken Hill" for about two weeks.—You can't say it, you have to sing it.

For the mill: there are two other stories in this issue that deserve your attention. One, the use of air float tables to handle coarse Virginia pyrrhotite, begins on p 114 and the other, a discussion of organic matter in ores and tailings dumps, by our good friend John Allingham, is on page 94.

In maintenance: we've been talking to some experts about some of the major mine maintenance problems and in this issue offer some of the results of those conferences. The whole plant can study inspection and repair of electric motors (p 99) and flame priming of surfaces before painting (p 86) with the promise of considerable profit for all.

And for a kicker: we recommend the article of Port Santa Barbara (p 96) as an excellent example of designing an ore shipping port which must operate during its own construction and expansion.

The printing fraternity is a group that practices what it preaches. Not only does it print magazines for other people (for instance, us), but for itself as well. One such house organ caught our eye a few weeks ago, and we found an item that seemed worth passing on, if only to refute the old idea that you can't do two things at once.

If you're an adult of average weight, here is what you accomplish every 24 hours:

Your heart beats 103,689 times.
Your blood travels 168-million miles.
You breathe 23,040 times.
You inhale 438 cubic feet of air.
You eat 3¼ lb of food.
You drink 2.9 quarts of liquid.
You lose 7/8 lb of waste.
You speak 4,800 words, many of them unnecessary.
You move 750 muscles.
Your nails grow .000046 in.
Your hair grows .01714 in.
You exercise 7-million brain cells.

And now, if you'll excuse us, we're gonna go lie down for a while.

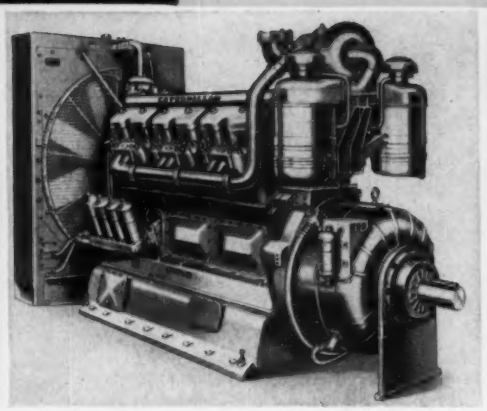
"Hate to see you go, Jones. It's hard to get engineers at the miserable salary we've been paying you."

A mining engineering student on Formosa read Bob Spoerl's "How to Select Your Conveyor Belt" in May and July 1957 *E&MJ* and wrote the author—"My father holds a new coal mine and I am to design the haulage equipment. But I am short of material and experience with conveyors. Would you be my professor?"

Mr. Spoerl planted some ivy at the Passaic, N. J. campus, donned his neoprene mortarboard and opened the school. One conveyor coming up!

engine power
BY CATERPILLAR

How powering your excavator with the Cat D397 (Series D) will give you an edge over competition



The dependable Cat D397 Engine for excavators—deservedly popular in coal and metal strip mining—has been proved, improved and perfected. For original power and repowering, this diesel is the leader in the field because it features a "full power" fuel system, fast governor response for sudden load changes and it's built for long working life.

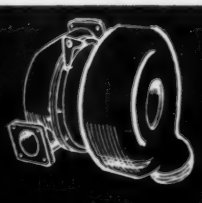
A dragline is only as productive as the power plant driving it. The Cat D397 (Series D) Engine is preferred "big diesel" power because through the years it has been constantly improved. Now turbocharged, boosting output 160 HP, it has full flow filtering, and steel-backed aluminum bearings doweled in place for stability. You get higher engine quality for less.

It means volume production of parts, too, with the same high-quality, low-cost result. Parts prices should always be reckoned in terms of the original investment. With purchase of a Cat Diesel Engine comes assurance of the best service and operating help and installation counsel in the industry. In the U. S. alone, Caterpillar Dealers have 7,500 experienced servicemen and over 2,000 field service trucks on call 24 hours a day.

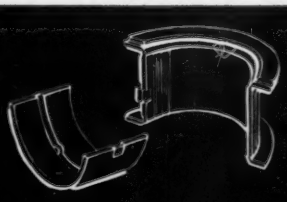
From 1950 to the present, Cat "V" Engines have powered the majority of big diesel excavators. Caterpillar policy of continual design improvement has resulted in over 100 major improvements in the D397 since that date. Repowering with Cat Diesels steps up production, for these power plants are free from delicate adjustments, they operate smoothly under a wide variety of loads . . . they are simple to service and easy to operate . . . they are easily started in any weather, and their dependability keeps equipment working.

So specify a Cat "V" Engine in your next diesel powered excavator. For money-saving repowering service, call your nearby Cat Dealer.

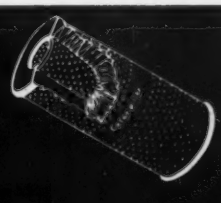
Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



Turbocharging the D397 gives higher horsepower per pound of engine weight, with operating economy and long life.

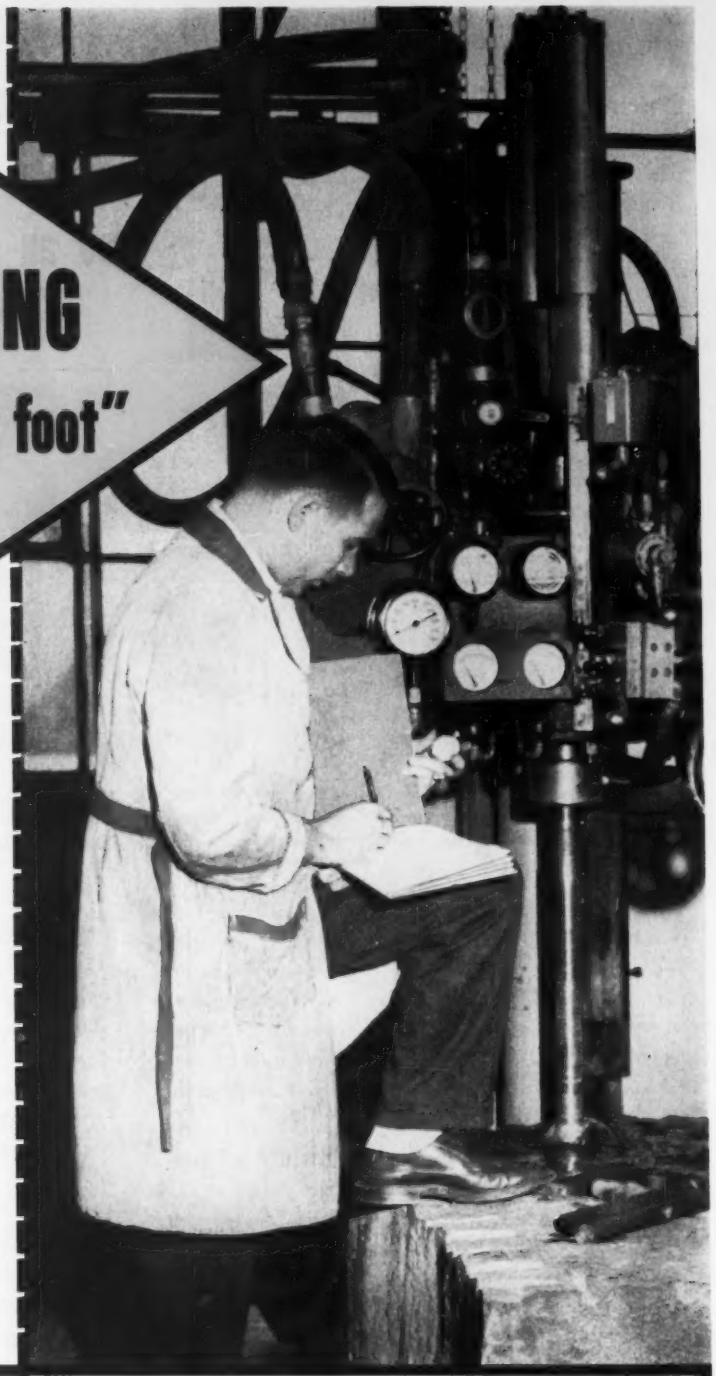


Main bearings are steel-backed aluminum alloy for better load capacity and better corrosion resistance.



Large capacity elements filter *all* the oil, give longer engine life. The elements are accessible, and easily replaced.

PRE-TESTING
MEANS
"less cost per foot"



The fundamental purpose of all Christensen Diamond bit research, whether in the field or in the laboratory, is to improve diamond bit performance.

This hydraulic diamond test drill, located in Christensen's main plant, provides a means of testing new bit designs, matrix composition and diamond sizes or patterns in a variety of rock types before field testing.

The rock used for these preliminary tests is gathered from many areas in the country and is selected from formations encountered in actual drilling operations.

These specialized tests enable Christensen engineers to increase penetration rates and improve bit life by determining the matrix materials and bit designs that assure the best results in each rock type.

For the right bit for your drilling requirements, call the nearest Christensen representative and learn how you can operate at "less cost per foot."

Diamonds Mean, "Less cost per foot."

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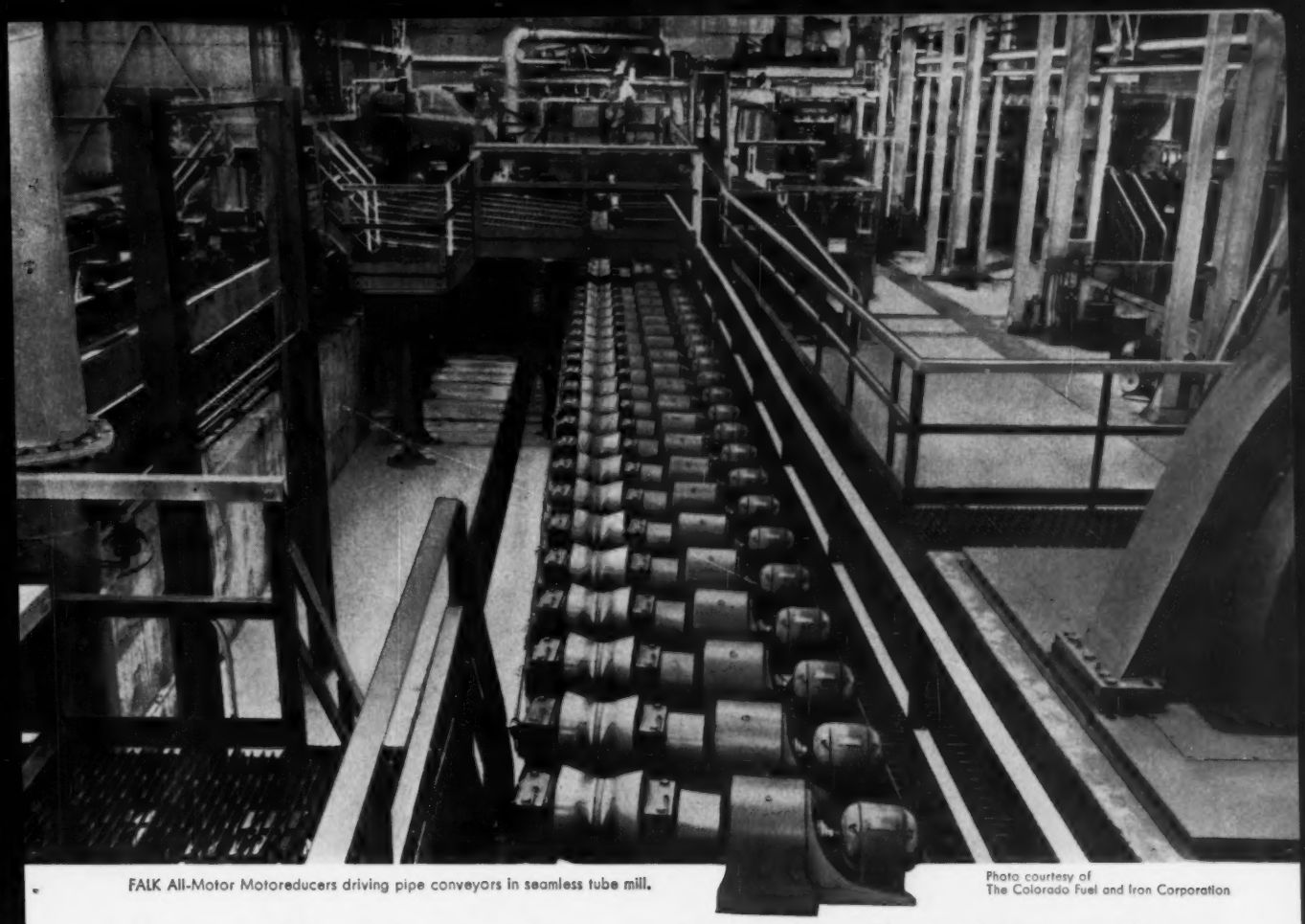

FALK All-Motor Motoreducers driving pipe conveyors in seamless tube mill.

Photo courtesy of
The Colorado Fuel and Iron Corporation

You get these "extras" when you buy FALK *all-steel* Motoreducers

1. **Freedom from damaged housings.** The exclusive FALK *all-steel* construction gives full protection from cracked housings or torn-off feet...plus twice the ability of cast iron to maintain vital alignment.
2. **12-15% reserve load-carrying capacity** in the gears, by AGMA standards. The extra-depth, high pressure angle helical gears are another FALK exclusive ...they assure better operation and longer gear life.
3. **Highest known gear efficiency**—98½% per gear train under full load! This means maximum productive work for your power dollar.
4. **Longer service life**...advanced FALK design makes it possible to machine both bores for each shaft assembly at one time, thus eliminating possible accumulation of tolerances that occurs when individually machined parts are assembled. The result—better alignment of revolving elements that permits units to transmit rated capacity longer.
5. **Standard units to fit your needs.** Integral and All-Motor® Motoreducers are available in horizontal, vertical and right angle types...a type for every use.

Units are available up to 75 hp; output speeds from 780 rpm down to 1.2 rpm. Prompt delivery from factory, warehouse or distributor stocks. Ask your FALK Representative or Authorized FALK Distributor for *Bulletin 3100*.

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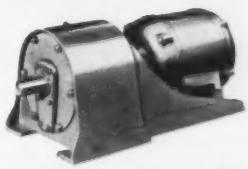
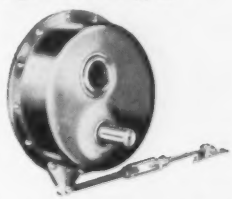


THE FALK ALL-MOTOR® MOTOREDUCER
the original All-Motor unit

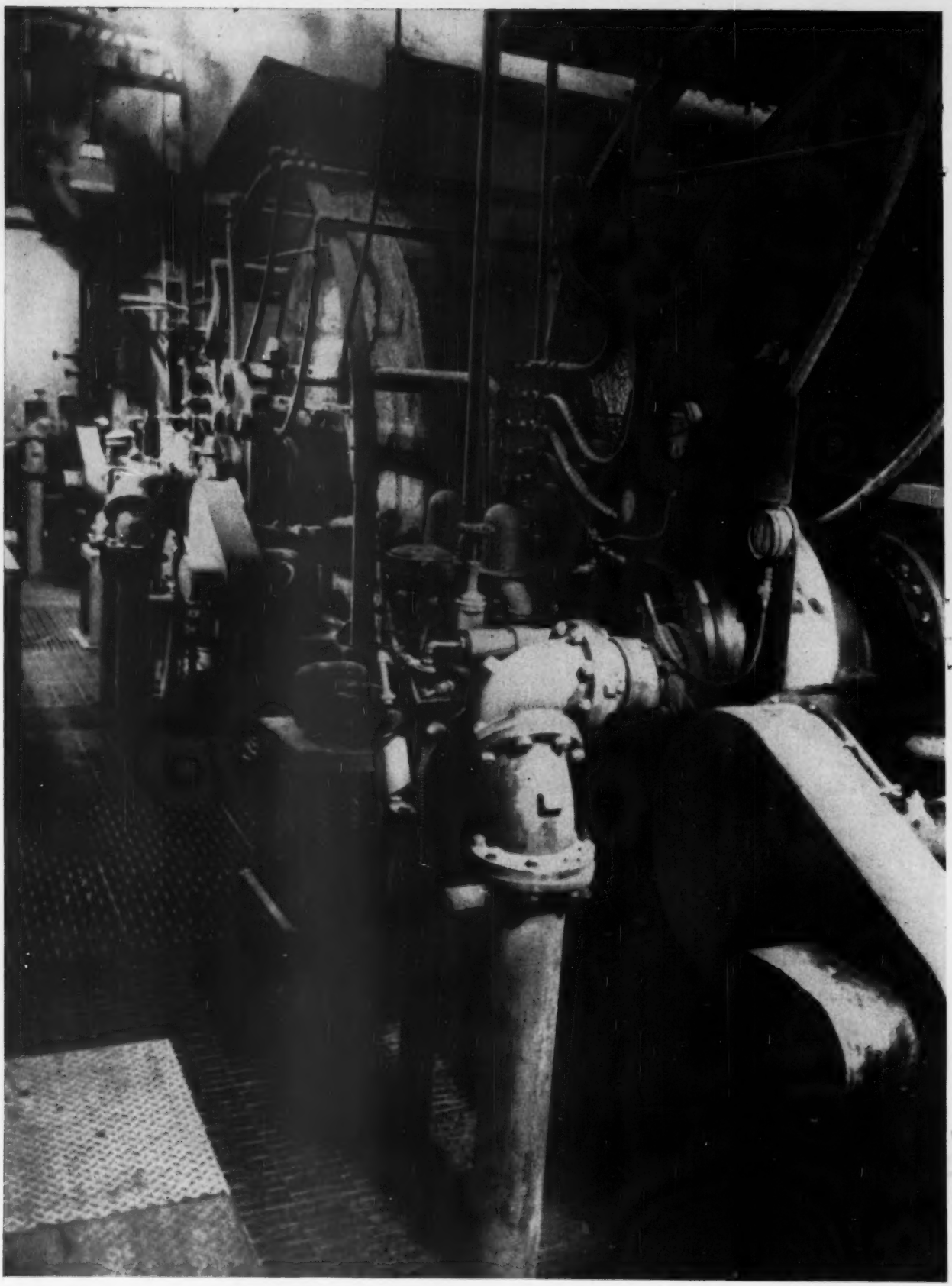
(Shown) Horizontal concentric model. Also available in right angle and vertical types.



THE ALL-STEEL FALK® SHAFT MOUNTED DRIVE

Proved best for the countless industrial applications where a reducing unit mounting directly on shaft of the driven machine is indicated.

Units from 1/2 to 50 hp. Ratios —4:1, 14:1 or 24:1. Torque capacity up to 41,000 lb-in (in standard units). Prompt shipment from stock. For details, ask for *Bulletin 7100*.



SUCCESS STORY AT ANACONDA'S GRANTS, NEW MEXICO, URANIUM MILL

tonnage up, maintenance down, using OLIVER DRUM FILTERS with new snap in-out rubber grids

Ore from the famous Jackpile ore body is processed at Anaconda's Grants, New Mexico, carbonate leach uranium mill. In the 1954 expansion program, three Oliver Continuous Rotary Drum-Type Filters were substituted for batch filtration equipment previously used. Easily removable snap in-out support grids, an exclusive Dorr-Oliver feature, were originally of wire, but have since been replaced by the Company's recently developed rubber waffle-type.

The Oliver filters have been in continuous operation since Spring, 1955, with no shutdowns except for cover changes. Since installation of the rubber grids, tonnage handled has been nearly doubled from 300 to 600 tons per day. Cloth life averages 60 days. The combination of high production and exceptionally low maintenance expense has resulted in substantial cost reductions per ton of ore treated.

Filtration is carried out in three stages, with repulping between stages. Additional Dorr-Oliver equipment includes O.D.S. Diaphragm Type Pumps on Filtrate and Slurry Service. Slurry handled contains 50% solids. There are also acid-proof Dorr FH Classifiers and DorrClones on acid leaching service and Dorr Agitators on autoclave discharge. A noteworthy feature is the use of Dow "Seperan" to improve filtration. As a result, loss of water solubles has been reduced to a very low level.

The know-how of Dorr-Oliver engineers is based on over 50 years of world-wide experience in handling every type of filtration problem. For more information on Dorr-Oliver equipment or for assistance on your particular problems, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER
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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U. S. A.

Photo shows installation of 3 Oliver Drum Filters at Anaconda Copper Mining Company's uranium mill, Grants, New Mexico. Filters are 11'6" diameter x 18' face, with snap in-out waffle type rubber grids. Each filter handles about 600 TPD of ore.

Seperan, Reg. Trademark Dow Chemical Co.

DorrClone and Oliver are trademarks, Reg. T.M. U.S. Pat. Off.

Model 480 Michigan does push-loading job normally requiring two big track-mounted machines working in tandem.

600 hp Michigan, stripping uranium overburden,

push-loads 30 yds: 48 seconds

Pushing singly, this giant Michigan Dozer regularly heaps 30 yard scrapers *in 48 seconds!*

Its high speed of pushing, back-up, and positioning enables the huge Michigan, *by itself*, to handle loading of five of these big pans on cycles as short as 2,000 feet.

Its job is on a 5,000,000 yard per year stripping contract for Lucky Mc Uranium Corporation, on their property east of Riverton, Wyoming. Material varies from tight hardpan to loose sand and gravel. Company officials chose the 52 ton, 600 hp rig, biggest of four Michigan Dozers available (the others: 165, 262, 375 hp), for both pushing and pit-floor dozing.

In normal pusher operation, the big Michigan works in a cut 50 to 80 ft deep, 600 ft wide. As each scraper drops its pan, torque converter-equipped Michigan makes smooth contact, drives ahead in second gear. Detailed time studies, covering over 300 loads and made under a wide range of temperature and weather conditions, show the scrapers heaped and on their way in *an average of 48 seconds*. Loads scale out at an average of 30 loose, 23.6 bank yards! With Michigan's power shift providing instant change of speeds and direction, back-up and positioning time average only another 25 to 30 seconds per scraper. Boosting load out of cut takes 4 seconds. Scraper output, with the Michigan pushing, regularly averages 38 loads (894 bank yards) per 50-minute working hour.

The Michigan's 28½ mph speeds on rubber make it a natural for handling scattered emergency tasks and occasional fill dirt dozing, too.

If you have similar big-yardage scraper or dozer jobs, perhaps this big mobile Michigan can give *you* similar cost-cutting advantages. It will cost you nothing to find out. Just call your local Michigan Distributor (or us) for a detailed on-your-job analysis and possible test demonstration.

Michigan is a registered trademark of

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
Benton Harbor 8, Michigan

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Actual performance records prove it – you can cut your costs on the world's toughest jobs–when your tires are mounted on Tru-Seal Tubeless Rims by Goodyear. This is the rim that has been adopted by the Tire and Rim Industry for tubeless replacement of all conventional tire sizes 12:00 and larger.

Tru-Seal is the only practical way known to seal a multiple-piece rim. And like all Goodyear Rims, it offers these practical, moneysaving advantages:

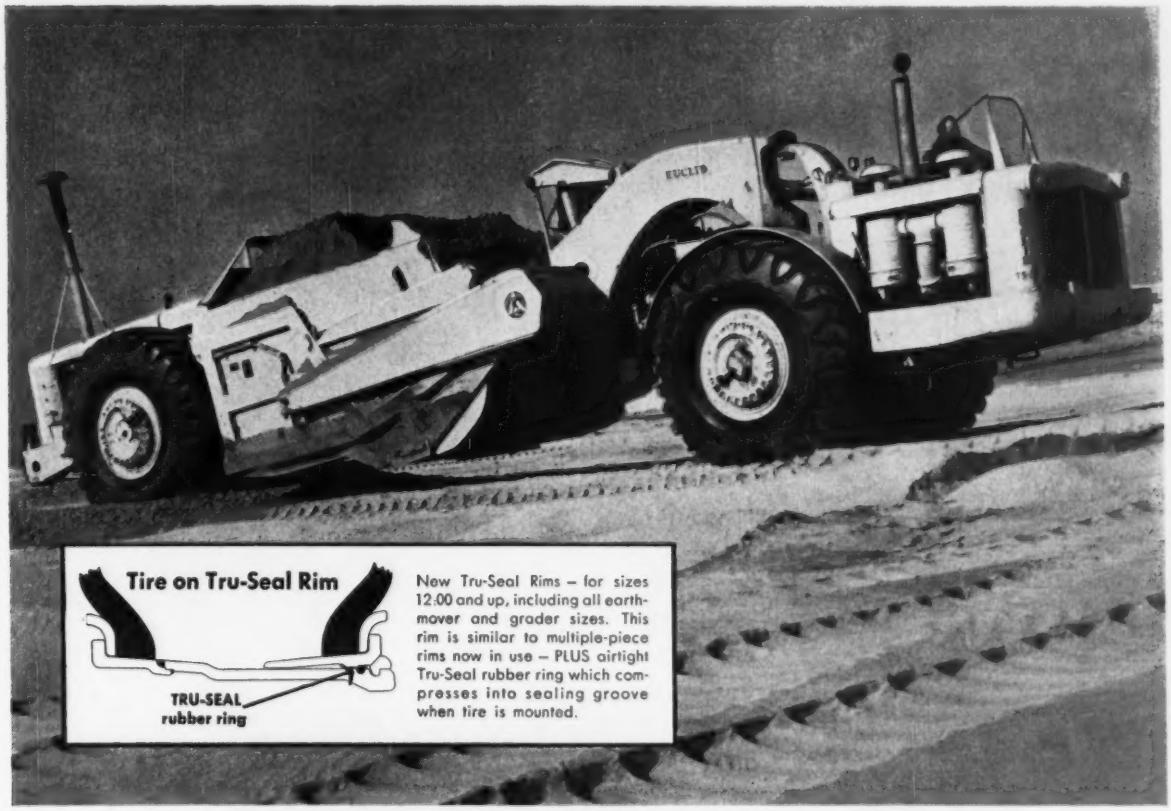
Unusual Strength: Thanks to an exclusive double-welding process, and added support at points of greatest stress, present-day Goodyear Rims are far stronger than previous rims.

Ease of Tire Mounting: No tube and flap troubles.

Special Tools: Goodyear provides both hydraulic and hand tools especially made for off-the-road equipment.

Bond-a-Coat Finish: This protective coating affords long-lasting resistance to rust and corrosion.

If you have a rim problem, talk it over with the G.R.E. (Goodyear Rim Engineer). He'll save you time and money by helping you select the type and size of rim best suited to your needs. Write him at Goodyear, Metal Products Division, Akron 16, Ohio, or contact your local Goodyear Rim Distributor.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Tire on Tru-Seal Rim
TRU-SEAL rubber ring
New Tru-Seal Rims – for sizes 12.00 and up, including all earth-mover and grader sizes. This rim is similar to multiple-piece rims now in use – PLUS airtight Tru-Seal rubber ring which compresses into sealing groove when tire is mounted.

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rubber make it a natural for handling

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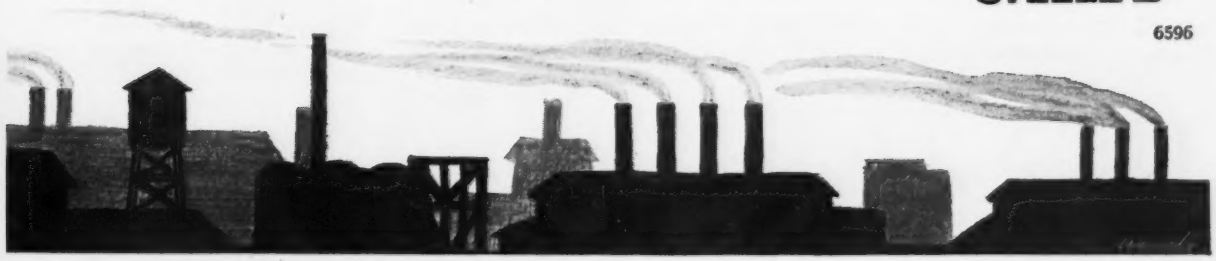
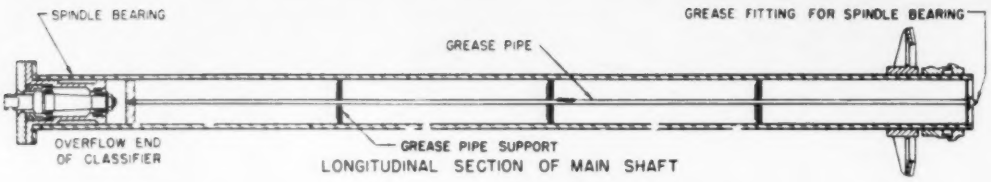


Exclusive Akins Features

which assure low-cost, trouble-free operation of classifiers, heavy media separators and densifiers



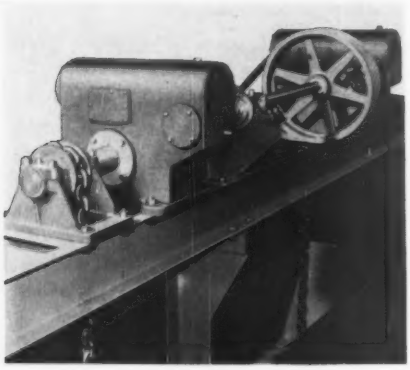
LONGITUDINAL SECTION OF MAIN SHAFT

SUBMERGED BEARING

The patented submerged bearing has proven its advantages of durability, trouble-free operation, and ease of maintenance. Special mechanical design results in long bearing life; effective sealing prevents entry of pulp into bearing unit.

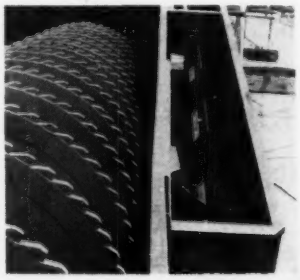
LUBRICATION

The submerged bearing is grease-gun lubricated through a pipe in the main shaft. Grease fitting is at upper end of shaft for maximum convenience. The grease pipe is isolated from tank contents. Since grease pipe is inside main shaft, it is fully protected against breakage.



MECHANICAL LIFTING MECHANISM

The lifting device consists of chains, chain sprocket sheaves, and motor-driven or hand-operated reducer unit. Experience has proven this mechanical arrangement to be the most positive, with no possibility of slippage...a factor of particular importance on densifiers. Minimum maintenance. Slimes or sands on chain do not affect operation of mechanism. No packing glands or rods to become worn.



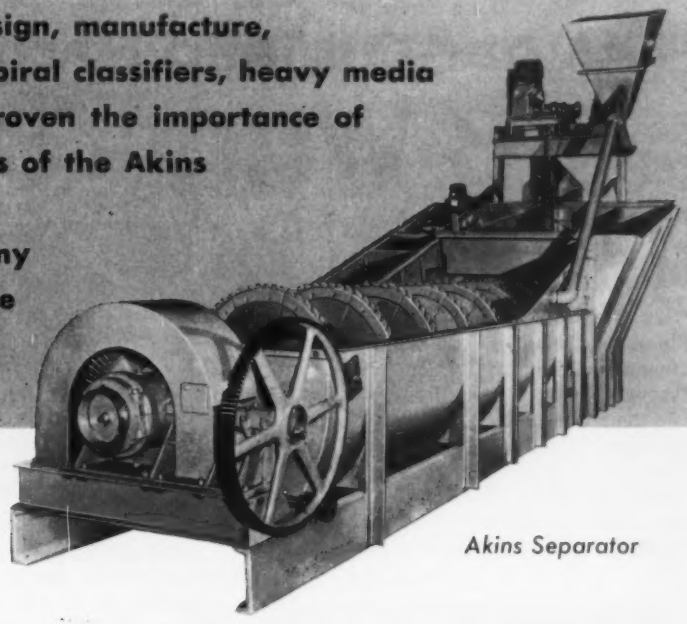
WEARING SHOES

Wearing shoes are made of various alloys, including Climax 42-A. The patented serrated wearing shoes are effective on certain applications to improve drainage and reduce wear; they also facilitate digging the spiral into a partly solidified bed after shutdown. Special inner shoes are provided for heavy rake loads.

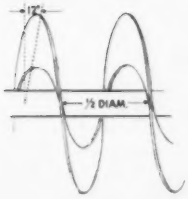
DRIVE

The bevel gear, V-belt drive has proven to be the most trouble-free and flexible. It permits mounting the motor, or motor-reducer, horizontally; and changing speeds quickly and inexpensively, by simply changing V-belt sheave ratio.

50 years of experience in the design, manufacture, and operating performance of spiral classifiers, heavy media separators and densifiers, has proven the importance of the exclusive mechanical features of the Akins machines... importance in terms of metallurgy, and in the economy of long, trouble-free operating life with minimum maintenance.

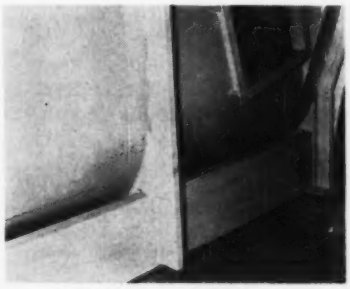


Akins Separator



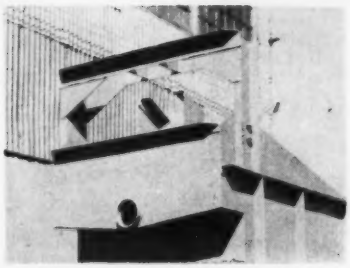
SPIRAL PITCH

50 years of experience has shown that the half-diameter pitch gives maximum raking capacity and results in less slippage and less wear than advanced pitch spirals.



TANK SUPPORTS

Web beam substructure supports tank. There's no load to be carried by tank. This also reduces installation cost by eliminating need for extra sub-structures to support tank.



OVERFLOW BOX

An overflow box, with a pipe connection, is furnished as standard . . . requires only a single connection.

Specialized engineering and laboratory testing services available for ore-milling problems.

For complete information on Akins machines write for catalogs.

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Wear-O-Matic Hard Surfacing is 3 Ways Better

1 *Faster . . . More Economical*

The Wear-O-Matic process of semi-automatic hard surfacing is continuous welding with manual control of the arc. However, unlike manual welding with stick electrodes, there is no time consuming slag cleaning or electrode changes. Higher deposition rates, 3 to 5 times faster than stick electrodes, greater deposition efficiency, 85 to 95%, plus more available arc time add up to savings of 40 to 50% over manual hard surfacing with stick electrodes.

2 *Uniform Resistance to Wear*

The superior wear resistance qualities of Wear-O-Matic hard surfacing wires is the result of closely controlled manufacture, properly balanced alloys and fluxing agents, and precision drawing. Wear-O-Matic 7/64″ diameter open arc wires are precision drawn to true wire diameter ± 0.002″ and through drawing are densely compacted assuring an easier feeding wire that will not crush in the feed rolls or bind in the feed cable. Dense compaction and closely controlled fabrication combine to provide a weld deposit more uniform in chemistry and metallurgy resulting in uniform hardness and greater wear resistance throughout the deposit.

3 *Greater Efficiency and Ease of Application*

Here's a hard surfacing combination *designed* to cut maintenance cost through the *profitable* utilization of your welder's time. Wear-O-Matic wires in WELD-PAKS are the key to greater efficiency of both semi-automatic equipment and operator. Each WELD-PAK contains 100 pounds of wire packaged in a "dead cast" resulting in tension free, snarl free feeding. Because the WELD-PAK contains 2 to 4 times more wire than standard coils, the amount of time spent handling wire is lessened, providing more time for welding. WELD-PAKS are easier to handle and store; and on the job, the lid can be replaced after use assuring dirt and dust free wire when you are ready to resume welding. From set-up to finished job, the Wear-O-Matic process is easier and faster, eliminating overtime or providing more time for other maintenance jobs. Job test this time saving process in your own shop. Request Bulletin HS-149 for complete details. Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.

Wear-O-Matic Wire Feed Unit $279.00 f.o.b. York, Penna. or El Segundo, Calif.

Weld-Pak is the trade name for this exclusive Wear-O-Matic package.

Alloy Rods Company

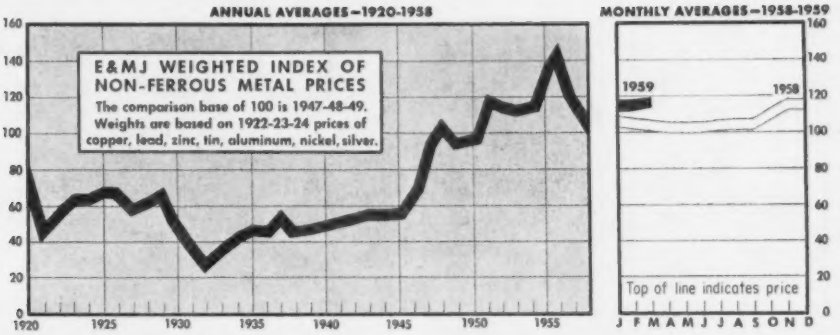
YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

NO FINER ELECTRODES MADE . . . ANYWHERE

E&MJ OUTLOOK



MARKETS

Higher copper, silver and tin prices during March more than offset lead and zinc price drops, and nudged E&MJ's metal price from index 117.6 for February to 119.9 for March.

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AT HOME

Three out of 12 diamond drill holes have penetrated commercial-grade copper ore on a 5,000-acre area being explored for iron ore by American Zinc Co. and Granite City Steel Co. in southeastern Missouri. Maximum thickness of the zone penetrated is 100 ft. The two companies have 10,762 acres under lease and option near Bourbon and Boss-Bixby, Mo.

Michigan's Governor Williams said that the availability of pipeline gas to northern Michigan by 1960 will bring an "industrial renaissance" to mining companies operating in the Upper Peninsula.

Pan American Sulphur Co. will build a $500,000 dry bulk and liquid storage facility at Tampa, Florida to improve service to customers.

Calumet & Hecla's $3.5-million magnesium plant at Selma, Ala. will have an annual productive capacity of about 12-million lb of magnesium. Operation is scheduled to begin by fall.

Primary aluminum production by the domestic industry totaled 156,708 tons in January, a new all-time high.

Inspiration Consolidated Copper Co. will spend $15,850,000 during the next two to three years to develop the underground mine at Christmas, Ariz. Ore reserves are estimated at 20-million tons containing 1.83% copper.

U.S. Bureau of Mines has core-drilled extensive manganiferous deposits on the Cuyuna Range, Minn., as part of an extensive program to develop domestic manganese sources. Results of the drilling are reported in Report of Investigations, 5450.

Kennecott's Utah Copper Division will modernize the heat treatment of molybdenum concentrates to improve recovery. Utah Copper produces about 1,750,000 lb of molybdenite monthly.

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LABOR

Members of the International Union of Mine, Mill and Smelter Workers threw out leaders of the International Nickel Co. strike, terminated in Sudbury late last year, by a vote of 5,629 to 3,830. New leaders are seeking affiliation with the Canadian Labor Congress which ousted IMM&SW 10 years ago for alleged Communist domination.

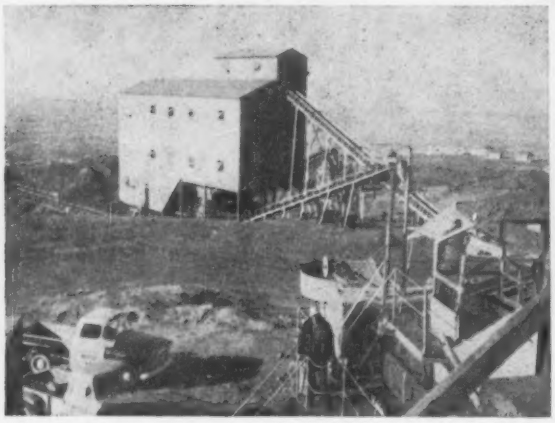
•

ABROAD

More extensive uses for natural diamond grit will be investigated by Consolidated Diamond Development Co., Ltd., established by Engelhard Industries of Canada, Lt.

Presence of ore deposits in northwest Tasmania, estimated to contain 200-million tons of high-grade iron ore, was reported by the Australian Weekly Review.

THIS MONTH IN MINING



MINERAL MATERIALS CO.'s crusher and magnetic separator plant was installed four years ago. The $2-million plant can handle 250 tph. C. W. Butler is assistant superintendent.

THE FORD MOTOR CO. pit is subleased and worked by Dodge Construction Co. Combination of Cat, Northwest shovel and Euclid truck move ore to the cobbing plant.

Nevada's Ninth Iron Ore Property Is Drilling

WHEN SOUTHERN PACIFIC CO. begins mining iron ore on its lands and leases 30 miles southeast of Lovelock, Nevada, it will be one of nine independent operators in one of the West's liveliest and most rapidly developing mining districts.

Underlaid by hundreds of millions of tons of marketable magnetite and hematite, the Mineral Basin Mining District extends through eight mile-square sections lying on both sides of the Pershing-Churchill county line. It is currently producing more than 15,000 tons of iron ore monthly and shipping an average of 200 carloads per month to mills throughout the U. S. as well as to Japan. The present revenue, estimated at more than $20,000 per week, will be increased considerably when the S.P. operation gets into production.

Largest current producer in the area is Mineral Materials Co., followed by Dodge Construction Co., Nevada Iron Ore Co., Consolidated Minerals Co., and John Heizer. Five other individual operators are working on leased claims and selling their ore to one of the five larger firms. A total of 125 men with equipment valued at millions of dollars are working in pits scattered throughout the eight-square-mile area.

Ore runs between 55 and 69% iron with relatively few impurities, and two upgrading plants are in operation. Ore between 55 and 60% is crushed and shipped to Japan, while higher percentage ore is marketed in the U. S. Among domestic buyers are Henry Kaiser, Bethlehem Steel, U. S. Steel, and numerous smelters along the Pacific coast and in Texas.

Principal claim holder in the district is H. S. Thomas, of Lovelock, head of Nevada Iron Ore Co., who, in addition to his own claims, leases one section from the S.P. and another from Ford Motor Co. These he subleases to Dodge Construction Co., which is currently mining from the Ford Pit, and to five individual operators who sell their ore to Thomas. From these purchases Nevada Iron Ore Co. has a stockpile of many thousand tons, and is marketing a steady supply of high grade magnetite to domestic smelters.

The five independent operators leasing from Thomas are working with seven compressors, three shovels, 18 trucks, three wagon drills, and eight loaders.

Dodge Construction Co., which is headed by Carl Dodge and E. J. Maupin Jr., both of Fallon, employs 35 men and uses a cobbing plant for upgrading. George Eckman is general superintendent. Ore is hauled from the Ford pit to the magnetic separator which is operated by a big diesel generator and which has a capacity of 75-tons per hour. Much of the Dodge output is sent to Japan, but it also sells high grade ore on the domestic market. In addition to its cobbing plant, Dodge is operating five shovels, five compressors, ten bobtails, six Euclids, 12 wagon drills, four loaders, a diamond drill and three cats.

Six miles south of the Dodge operations are the Mineral Materials mill and pits. Heads of the company are C. W. Dunton and A. S. Vinnell, both of Alhambra, Calif. P. W. Leidich is manager of the Nevada operation. The Mineral Materials magnetic separation plant was installed four years ago at a cost of $2-million and is housed in a large mill building. Ore is dumped into the crusher and moved by belt into the mill which has a capacity of 250 tons per hour. Mineral Materials keeps an average payroll of 30 men at the site, and has a stockpile of high grade ore totalling an estimated 85,000 tons. The company has been selling most of its output to Japan, but is presently building up a domestic market. It is operating five shovels, 20 bobtails, eight Euclids, two loaders, four compressors, ten wagon drills and three cats in addition to its mill.

Consolidated Minerals Co., which has its offices in Lovelock, is headed by R. F. Helmke, of Bradley & Eckstrom, San Francisco brokerage firm. It is operating two Cats and a shovel on one of the highest grade tracts in the area. During January, Consolidated shipped five carloads to domestic markets, all five of which ran above 65%.

John Heizer, of Lovelock, one of the first to produce ore in the district, is mining on land leased from the Southern Pacific. Under direction of R. W. Adams, superintendent of operations, a new pit is being developed with an 18-yd scraper, a ripper, two Cats and a skip-loader. Heizer has been a consistent shipper of ore from the district for the last 15 years.

The Southern Pacific Co., which owns half the land in the district as a result of Federal grants made to the firm when the first rails were laid in the early 1860's, is developing its current plans through its subsidiary, the Southern Pacific Land Co. Prior to Feb. 1 a total of 26,000 ft of diamond drill holes had been completed in a small area near the Mineral Materials holdings, and an additional 40,000 ft of drilling at a cost of $250,000 will be started early in the spring. Ore deposits totalling a reported 60-million tons have already been indicated. The company has announced plans to build one of the largest beneficiation plants in the West, and to construct a spur railroad line to the site when production begins.

The move is a new departure in policy for the S.P. which heretofore has leased its lands in the district to Heizer and to Thomas. Millions of tons of ore have already been mined and marketed from those leases. William McCulloch,

chief geologist, is in charge of the exploration work for the railroad company.

Present operators haul ore to the railhead on a wide highway which is maintained by the individual truckers who pay 10c per ton for road maintenance. The hauling distance from the Dodge installation is 18 miles and from the Mineral Materials plant 24 miles. The Dodge and Mineral Materials ramps are at Colado, and the Heizer and Thomas ramps are at Woolsey, five miles east of Colado.

Existence of iron ore in the district was common knowledge for many years, but it was not until 1940 that Heizer & Segerstrom began the first development on land leased from the S.P. Marketing at that time was done through Bradley & Eckstrom. In 1944 Dodge Construction Co. began mining iron ore in the area to sell as ballast. A few years later they started producing ore for smelting. Mineral Materials started operations in 1948 after Dunton had bought patents in the district which were sold for taxes.

Thomas and his partner Roy Blair, who pioneered the northern area of the district, leased S.P. land in 1950 and after developing that, established their own claims which they worked. Thomas later leased the Ford Motor Co. ground. Since then expansion of the area has proceeded steadily. It now promises to be a booming mining district for many years to come.

Mining Calendar

Third Symposium on Rock Mechanics, Colorado School of Mines, Golden, Colo., April 20 to 22.

Lead Industries Association, 31st annual meeting, with joint meeting, American Zinc Institute. Drake Hotel, Chicago April 22-23.

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, Pa., April 27, 1959.

American Society of Photogrammetry—American Congress on Surveying and Mapping, Washington, March 8-14.

12th Annual Midwestern Exploration Meeting, El Paso, Tex. April 28-29.

Southern Metals Conference, sponsored by Savannah River Chapter, American Society for Metals, Augusta, Ga. May 4-6.

Uranium Section, AIME, Moab, Utah May 8-10.

35th Annual Conference of Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn. May 21-22.

Open Pit Mining Association, annual meeting, Rolla, Mo. June 18.

Air Pollution Control Association annual meeting, Hotel Statler, Los Angeles, Calif. June 22-26.

Institution of Mining Engineers Symposium on Shaft Sinking and Tunnelling, Olympia, London, July 15-17.

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

(Continued on p 128)

As We Went to Press . . .

Iron Ore Co. of Canada will spend $150-million to develop a second major iron ore property in the Quebec-Labrador area. The new project, at Lake Carol, is in the vicinity of Wabush Iron's development at Lake Wabush (*E&MJ*, March 1959, p 18.)

The new mine and plant is expected to produce 6-million tons of high grade concentrates per year. At its Knob Lake operation, Ioco produced 7.8-million tons last year.

Cerro de Pasco Corp. has acquired the property of Consolidated Coppermines Corp. through an exchange of common stock and debentures. Chester D. Tripp, president of Coppermines, became a director of Cerro. In the transaction, according to Robert P. Koenig, president of CdeP, his firm also gained the controlling interest in Titan Metal Manufacturing Co. and Rockbestos Products Corp.

Aluminium Ltd. will spend about £100,000 in the formation of two new metal fabricating firms, Ghana Aluminium Products, Ltd. and Nigeria Aluminium Products, to operate in the respective nations in West Africa.

Availability of natural gas to the Upper Peninsula of Michigan has been announced in Detroit, with initial imports of 200-million cubic ft per day to commence in the fall of 1960.

Gov. G. Mennen Williams hailed the development, which will take gas from Alberta, as the beginning of "an industrial renaissance" for mines in the area.

Mineral Materials and Southern Pacific Land Co. are considering plans for joint construction of a pelletizing plant to handle iron ore in their Nevada operations. (See story at left.)

New proposals for Federal aid to domestic mining industries are coming thick and fast in a wave of Congressional concern over import policy, small mines economy and next year's elections. (See Washington Impact, p 20.)

The latest is a flood of bills introduced by Sen. Gordon Allott (R-Colo.) to dust off last year's proposed production payments and price supports for small lead, zinc and fluorspar mines, to free the gold market, authorize new coal research and development, and wrap the whole package up in a new directive to the Administration to write "A National Mining and Minerals Policy."

The Surinam government has invited Fried. Krupp, Essen, Germany, to mine a large iron ore deposit recently discovered in the former Dutch Guiana area, according to reports at Bonn.

Two vertical shafts will be sunk by Western Knapp Engineering Co. at Sperry, Iowa for U.S. Gypsum Co.'s gypsum mine.

The contract also calls for headframe erection on the hoisting shaft, installation of an underground ore pocket, skips, etc. and initial development on the mining level. The mine is to be ready for operation at year-end.

WASHINGTON IMPACT

Highlights

OLD ISSUES DON'T FADE AWAY—Mining and trade policy battles in Washington are heating up again, on Capitol Hill and in the executive agencies. Much of the new controversy of course is a rehash of last year's Administration compromises in both areas. But even warmed-over issues can get hot.

Within the flexible outlines of over-all Administration metal-mineral and foreign economic policies as they have taken shape over the past several months, there are a number of key developments to watch. They will unfold one-by-one in line with Washington's case-by-case approach to meeting them. However they interlock to a large degree, and a changing pattern could emerge.

SEN. MURRAY AND THE SUGAR ACT—Mining state Congressmen have firmed up their tactical drive for new Federal aid, settling on the Sugar Act approach proposed by chairman James Murray (D-Mont.) of the Senate Interior Committee. This is the plan to divvy up home markets between U.S. and foreign producers, assuring domestic producers of a minimum tonnage or price floor as is done in the case of sugar. (See story this page.)

This scheme has not been taken seriously any of the many times it has been brought up previously. But the general climate of increased import competition and fears of the Russian economic threat is at least assuring the Sugar Act approach to mining supports of a closer look than it ever has had before.

NATIONAL SECURITY & SECTION 8—Now that domestic petroleum and electrical equipment producers have had their shot at the key loophole in U.S. liberal trade laws through which domestic protection is now most readily available, the three minerals which have asked relief under the National Security clause are expected to get a ruling from Office of Civil and Defense Mobilization shortly.

These are cobalt, fluorspar and tungsten. Because fluorspar producers' complaints against competing imports have been chosen as the first test case for the Sugar Act legislative approach, OCDM may not rule on their Section 8 Defense Essentiality petition for some time. The agency is reported also to be unfavorably inclined to recommend import curbs on tungsten, in view of strong opposition from Korean suppliers.

Cobalt, however, stands the best chance of becoming the next commodity to win trade protection through OCDM. According to informed spokesmen, new military uses for cobalt, coupled with unrest in the primary foreign sources of this mineral—Cuba and Africa—may lead OCDM to urge restrictions on competing imports on a national defense basis.

LEAD & ZINC—Market sensitivity in lead and zinc makes those metals another straw in the policy wind. Dissatisfaction among domestic producers with the existing import quotas, coupled with the fact that State Department hopes for international production or export controls are still running up against stiff opposition from Canadian mining interests if not from Ottawa, adds new steam behind another push for Federal supports. Regardless of what happens to the fluorspar bill, Senate Mining Committee staffers plan to try the same Sugar Act gimmick on lead and zinc. In the background also is the still possible court test the legality of current lead-zinc import quotas as a result of the customs court decision in the bicycle case (*E&MJ*, November 1958, p 20).

BARTER & FERROALLOYS—U.S. importers of ferroalloys are unhappy with the nominally expanded barter program that was expected to boost crops-for-minerals trade. They claim provisions limiting domestic processing values which may be added to foreign ores are hurting their business badly. The complaints of these importers, traditionally at odds with domestic metal-mineral producers on over-all trade policy, may ironically force still another Congressional look at the whole barter program, which in turn has disappointed domestic producers by its failure to revive the siphoning-off of foreign mineral surpluses at its previous rate.

Mineral Aid Partisans Try "Sugar Act" Tack

TWO SEPARATE BILLS—both following the Sugar Act approach to guaranteeing domestic producers home markets—will test Congressional climate for this type of Federal support program.

The first, involving only fluorspar, was scheduled for hearings before the Senate Interior Committee the first week in April, as this issue of *E&MJ* went to press.

Another similar bill to provide for lead and zinc was set to follow close on the heels of the first.

The fluorspar bill would work this way:

Secretary of Interior Fred A. Seaton would be directed to establish annual consumption figures, the majority of which—in tons—would be allocated to U.S. suppliers the following year. A smaller percentage of the total take would be split up among importers on the basis of their historical records of shipments, based on a previous year standard. A flat quota would be set at a percentage of domestic consumption, beyond which imports would be cut off entirely.

The proposed lead-zinc legislation differs in several respects:

Under Commerce Secretary Lewis Strauss, the program would allocate quotas quarterly instead of annually on the basis of 1956 imports, and would be enforced by a domestic price standard rather than on the basis of set tonnages.

Domestic price supports would be set at 15½c per lb for lead, 13½c per lb for zinc, at which price or above imports would be allowed at 1956 quarterly rates. Below these supported prices, imports would be banned.

To soften the effect on allied foreign producing nations, the Agriculture Department's Commodity Credit Corp. would agree to barter surplus U.S. crops for the difference between actual imports under this program and the supplier-nation's 1956 share of the market.

Neither bill is a strong bet to win Senate, let alone House, approval, where mining influence is proportionately less powerful. Also, the Administration is not likely to approve, much less actively support either bill—even though the lead-zinc bill is based on the same price levels proposed by the Administration in the Seaton mineral subsidy bill defeated by the House last session.

Nevertheless a renewed climate of trade protectionism and concern over lead-zinc market instability (see Highlights, this page) may give the proposals a better hearing on Capitol Hill than previous proposals patterned after the Sugar Act have received in previous years.

Part of the concern in Washington over lead and zinc stems from State Department pessimism over chances of furthering steps toward international production or export controls at the next

United Nations conference, scheduled to get underway in New York March 28—April 4.

Tax Depletion Rules Bill Is Shelved By House

HOUSE WAYS & MEANS Committeemen have shelved the Administration's proposed legislation to spell out what processing steps may be included in tax depletion allowances. The Treasury Department ran into serious trouble at first with technical objections to its long and complicated list of proposed amendments to existing tax laws designed to close depletion loopholes opened up by recent Federal and Supreme Court tax decisions (E&MJ, February 1959, pp 23-24).

Freeport Sulphur Co., for example, complained that the Administration amendments apparently inadvertently excluded normal processing of its lower-grade mineral deposits in Louisiana.

Just as Treasury was getting ready to tackle the task of correcting its technical errors in its proposed legislation, influential House Tax Committeemen let it be known they had given up on the idea of considering any new tax depletion legislation so close to an election year. Their reason: the entire subject is too controversial. For one thing, consideration of any depletion amendments opens up the highly sensitive area of oil and gas depletion percentages.

Sometime this month, the Committee is scheduled to explore a limited compromise of the Administration bill, aimed at closing only the processing loopholes opened up in the manufacture of brick and clay tile by the Federal court rulings last year. Even this limited compromise, however, is regarded as doubtful of getting to the House floor, much less to the White House for enactment.

Gore Warns of Reaction To Protectionist Moves

THE STRONG PRESSURE for mineral supports in Congress as represented by the Sugar Act attempt and other pressures (see left) is having its own reaction. Sen. Albert Gore (D.-Tenn) a champion of reciprocal trade, recently suggested price controls on metals, which observers saw as a warning to protectionists.

USBM Gets Budget Funds

BUDGET APPROVAL in the House for Interior Department's Bureau of Mines activities in the area of conservation and development came painlessly by voice vote last month, indicating this is one Administration mining aid Congress is in no mood to cut. The appropriation calls for just over $21-million. House approval was the more significant in view of the fact that the Congressmen okayed a $19-million over-all Administration cut for Interior Department.

Labor This Month

MINE-MILL TARGETS NEW CONTRACTS: Leaders of the International Union of Mine-Mill and Smelter Workers have drawn a bead on 1959 wage talks with the nonferrous industry, and the sights for this year are far higher than the last negotiations back in 1956. In fact, the labor officials cite the three-year contracts—to expire June 30—as the basis for a number of union frustrations over its wage and fringe benefits. As a result, they're planning to hit hard in bargaining, starting next month. The strategy was laid out at Mine-Mill's 54th convention before some 250 delegates who then took it home to their union locals. Here's the way the demands will look:

WAGES—TO OUTSTRIP 1956: A top goal is the straight pay increases that will be demanded. Although this isn't finally set, Mine-Mill wants more than the 8c average over the past three years. Besides a flat percentage boost, the pressure will be to add a cost-of-living adjustment clause to the nonferrous contracts. Absence of this built-in wage lift, the union negotiators argue, has thrown Mine-Mill gains behind the combined rise in living costs and productivity. This latter point—the increased output per man—will be the basis for some heavy bargaining over outright wages.

FRINGES—MORE AND BETTER: The pre-bargaining talks center on standard improvements in existing health and welfare benefits, with the goal to put the full welfare costs on the companies. Also, Mine-Mill is talking about premium pay for weekend work, both Saturdays and Sundays. The third demand in this area will be Mine-Mill's version of supplementary unemployment benefits—probably patterned after the United Steelworkers unemployment benefits. These come to 65% of take-home pay for 52 weeks a year.

THE SHORTER WORKWEEK IRON IS HOT: For some years, Mine-Mill has bargained—to no avail—for a 32 hour week to replace the present 40 hours. This demand has been traded off quickly in the past, but in next month's talks it will be a prominent subject. Even Mine-Mill officials anticipate too much resistance to go far with this one, noting that it will "require an all-out struggle by all unions" to cut back the working hours. But, this is the first year that all unions—including the big steel and rubber unions—will be pressing for the cut.

THE BARGAINING APPROACH—SPLIT THE GRAVY: MMSW researchers are arming their negotiators with figures to back these demands—details on rising productivity and dwindling employment. According to Mine-Mill estimates, copper production "is now fully recovered" from the 1958 recession. But, they add, employment is down by 7,000 from the high of two years ago. This, despite the rehiring of 2500 workers from the bottom of the 1958 recession. Mine-Mill now officially estimates its membership at 80,000, down 20% from three years ago.

THE LONG-TERM CONTRACT—A TRADE: MMSW officials are doing some advance bargaining on the extended contract. They claim the three-year agreement has been too long and too costly; that Mine-Mill won't go for this again in the same kind of contract as 1956. While nonferrous management may promote the same three-years again as a stabilizer to the industry, they'll be asked to make an exchange. The union, this time, wants contract adjustments during its life. The labor negotiators will insist on either of two approaches: a cost-of-living clause that would lift wages if prices rise and/or a wage re-opening clause during the contract course. Otherwise, they'll counter with a one or two-year contract proposal.

THE PROSPECTS—FIREWORKS: It's anybody's guess whether a strike is coming. But certainly the elements are for some tough talking. MMSW must demand high in the face of their high productivity estimates. But, they must bargain also in the face of sizable unemployment which isn't expected to improve substantially. This is not the solid base Mine-Mill would like to bargain from. It is such a situation that can lead to trouble.

MARKETS

U. S. Copper Producers Raise to 31½c; Lead Down ½c; Aluminum Price Cutting

MARCH NON-FERROUS METAL PRICES as measured by the E&MJ revised index rose to 119.9% of the 1947-'49 average from 117.6 in February. An increase in copper prices more than offset lower lead and zinc prices. Silver and tin were up slightly.

Copper prices in the U.S. were boosted by producers. Anaconda announced late Friday, March 6, its price on March 9 for electrolytic copper, standard shapes, would be 31½c per lb delivered in the U.S. Other major producers made the same announcment on March 6. The price increase reflected the sharp demand increase for copper in the U.S. and price rises of custom smelters and dealers. Prices had also gone up outside the U.S. Custom smelters in the U.S. had been at 31½c delivered but March 5 sales were made at 32c. Merchants were 1c or more higher.

Prices on the N.Y. Commodity Exchange (CX) and the London Metal Exchange had moved up. On March 4 LME prompt settlement was about 30¾c, up about ¾c in three days. Prices did not stop there—LME prompt reached £257¾, about 32.34c, March 17. CX on March 16 had reached 34.9c for July copper. Custom smelters by March 16 had raised to 34c; they remained at this price through the month. Dealers raised to 35c and some sales were made at over 35c.

The surge in prices led some to believe U.S. producers might raise to 32½c. Most producers felt 31½c would give a good profit margin and some have said runaway prices should be resisted. Many copper company officials believe 31½c will not actively push consumers away from copper to competing materials, but that as the price goes above it some such movement will occur. The attitude expressed by company officials is largely a reflection of each company's production costs.

Price easing appeared March 18 on the LME and CX. The afternoon LME call on the 18th was almost 1c under the morning call on the 17th. The N.Y. CX was down for July copper 1.9c part of the day; before the end of the day it had recovered most of the loss. London reached £243¼ on the 23rd and then rose to £249½ (31.35c) settlement on the 31st. CX also rose.

The lower prices on the two exchanges reduced dealer prices in the U.S. and Europe. But neither U.S. producers or custom smelters dropped. They, along with other sellers and many buyers, believed the easing was largely profit taking by longs.

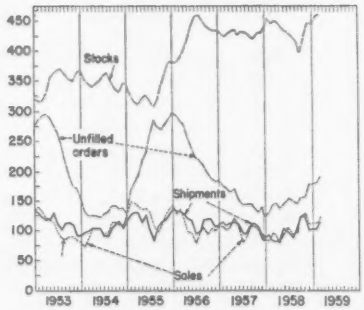
Perhaps the major effect was release of copper scrap by scrap dealers. Custom smelters had been unable to get as much scrap as they wanted at their offering prices. Scrap dealers held metal with the thought the scrap price might rise. When exchange prices slipped dealers rushed to sell and turned over heavy amounts to smelters. Some analysts even suggested smelters had started selling on the exchanges in order to drop prices and bring out scrap. Smelters paying price dropped for no. 2 scrap by over 1c; by the end of the month is had recovered most of the drop.

The fundamental reasons for the earlier price firmness remained. Copper was tight in the U.S. and the probability of severe strikes in the U.S., unrest in Africa, and increasing business activity suggested drastic metal scarcity in a few months.

Strikes already were hitting the copper industries. Asarco's Tacoma refinery which had been producing 5,000 tpm of electro almost all of which was consumed outside the U.S., was struck in mid-March and prospects at the end of the month were for continued stoppage. Anaconda's properties in Butte were struck owing to a dispute between Mine-Mill and one of the R.R. unions. A court order reopened the properties until April 6 at which time a strike was expected unless the court continued its restraining order. Three strikes were settled early in the month: Kennecott's strikes at the Ray division in Arizona and in Chile, and the Cerro de Pasco strike in Peru. Kennecott's Chino division in New Mexico (6,000 tpm blister), was struck April 2.

Copper statistics showed good business.

U. S. Copper Fabricator Data



U. S. Copper Association data, thousands of short tons, through February. Sales, shipments and unfilled orders are for fabricated products. Stocks also include refined copper. Sales and shipments are two months moving averages.

Tonnages reported to E&MJ for calculating weighted average copper prices showed heavy pricings in March both in and outside the U.S. Except for the last week when most of Europe was on an extended holiday, foreign sales were exceptionally high. Copper Institute data showed February shipments in the U.S. up further and very high relative to the 1958 average; shipments outside the U.S. were down. Stocks remained low in the U.S. but rose outside the U.S. Fabricator statistics for the U.S. showed product shipments, sales and unfilled orders up further.

Aluminum activity, exclusive of shipments to Government, picked up somewhat recently but Nathanael Davis, president of Aluminum Ltd., in the firm's annual report, said "It seems likely therefore that even with a resumption of recent consumption growth rates, the producing industry must look forward to a condition of oversupply for the next few years until a further rise in demand restores the balance."

Price cutting on aluminum products and pig has been accentuated. Some extruders fear primary producers will cut the billet price by 1c—this would so squeeze converters of pig (to billet) they might be forced out of business. It is doubtful the fear of this 1c cut will keep them from continuing to buy imported pig. Freight allowances given by primary producers on pig have increased to the point where in some cases it is more than 1½c above actual freight.

Lead was dropped by a leading custom smelter to 11c per lb New York on April 1. Sales had been very slow since the price was raised to 11½c March 6. Heavy sales had been made during the preceding two weeks when the price was 11c. It was apparent U.S. buyers felt they were paying too high a price relative to European prices. London had dropped to about 8⅛c March 31. This drop in turn reflected the fear the U.S. Government would take greater measures to exclude foreign lead.

Zinc prices remained at 11c East St. Louis all month. Sales had been very slow until the third week when they were about three times as great as any other week of the month. U. S. stocks rose about 5,000 tons in February. Most factors suggest the present price will hold.

Manganese ore business continues slow. Some importers last year believed that when steel activity increased consumers would again purchase manganese ore. Stocks held by U.S. consumers were very high. Normally manganese ore is bought on contracts for delivery over a period of a year or more and when steel output dropped ore accumulated or its delivery was stretched out.

Imported ferro sells for $35 to about $75 a ton under quoted U.S. prices.

Average Prices March (*E&MJ Quotations*)

Copper:

Electrolytic, domestic refinery	31.031
Electrolytic, export refinery	30.271
Electrolytic, c.i.f. Cont'l ports	31.216

Lead:

Common, New York	11.412
Common, St. Louis	11.209

Silver:

Silver, New York, per oz.	91.351
Silver, London, pence per oz.	79.281

Zinc:

Prime, Western, East St. Louis	11.000
Prime, Western, delivered (g)	11.500

Tin:

New York Straits	103.119
Gold, per oz., U. S. price	$35.000
Sterling Exchange	281.271
Quicksilver, per flask	$224.636
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$76.727
Cadmium (a)	145.000
Cadmium (b)	145.000
Cadmium (c)	145.000
Al., 99½ dom., ingot	26.800
export, pig	22.500
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free' Gold Market

International gold dealings continued their slight decline with volume shrinking 7% in March. Bar prices rose again to historic highs in India but showed only minor changes in West European and North American markets. Coins rose fractionally in most centers. No Soviet gold sales were reported but production has been estimated to be higher than that of the Union of South Africa. American gold losses were nominal and the gold stock remained practically unchanged from last month. Pick's World Currency Report quotes on "free gold" per fine oz. as follows:

	COINS		BARS (12.5 kg)	
	Feb. 28	Mar. 31	Feb. 28	Mar. 31
NEW YORK transit	.....	.....	$35 08⅛	$35 08⅛
MANILA	$42 00	$42 00	36 10	36 15
HONG KONG	46 60	46 60	38 75	38 70
BOMBAY	65 40	64 00	63 25	63 50
TANGIER	40 60	40 75	35 25	35 25
BEIRUT	41 60	41 25	35 19	35 19
PARIS	40.00	40.50	35.60	35.65
BUENOS AIRES	38.25	38.50	35.90	35.80

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of March reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant 31.750 lb
F.o.b. refinery ..... 31.350 lb

Correction: The October 1958 monthly average has been revised to 28.500c del.; 28.100c F.o.b.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Mar. 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f.(c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99½% U. S. Dest.	Straits Tin New York
2	29.750	29.200	30.145	11.000	10.800	11.500	11.000	24.700	104.500
3	29.700	29.325	30.270	11.000	10.800	11.500	11.000	24.700	104.125
4	29.625	30.000	30.945	11.000	10.800	11.500	11.000	24.700	103.750
5	29.850	30.100	31.045	11.059	10.800	11.500	11.000	24.700	103.250
6	29.725	30.025	30.970	11.500	11.300	11.500	11.000	24.700	102.250
9	31.150	30.125	31.070	11.500	11.300	11.500	11.000	24.700	102.000
10	31.100	30.350	31.295	11.500	11.300	11.500	11.000	24.700	102.750
11	31.100	30.525	31.470	11.500	11.300	11.500	11.000	24.700	103.500
12	31.100	30.525	31.470	11.500	11.300	11.500	11.000	24.700	103.500
13	31.175	30.600	31.545	11.500	11.300	11.500	11.000	24.700	103.250
16	31.775	30.825	31.770	11.500	11.300	11.500	11.000	24.700	103.500
17	31.800	31.400	32.345	11.500	11.300	11.500	11.000	24.700	103.500
18	31.350	31.300	32.245	11.500	11.300	11.500	11.000	24.700	103.375
19	32.100	30.800	31.745	11.500	11.300	11.500	11.000	24.700	103.500
20	31.775	30.200	31.145	11.500	11.300	11.500	11.000	24.700	103.250
23	31.500	29.750	30.695	11.500	11.300	11.500	11.000	24.700	102.750
24	31.250	29.850	30.795	11.500	11.300	11.500	11.000	24.700	102.500
25	31.200	30.150	31.095	11.500	11.300	11.500	11.000	24.700	102.250
26	31.775	30.150	31.095	11.500	11.300	11.500	11.000	24.700	102.750
27	31.250	30.125	31.070	11.500	11.300	11.500	11.000	24.700	Holiday
30	31.375	No Quote	No Quote	11.500	11.300	11.500	11.000	24.700	102.750
31	31.250	30.375	31.320	11.500	11.300	11.500	11.000	24.700	102.500
AVERAGES FOR MONTH									
Mar.	31.031	30.271	31.216	11.412	11.209	11.500	11.000	24.700	103.119
AVERAGES FOR WEEK									
Mar.									
4	29.690	29.410	30.355	11.000	10.800	11.500	11.000	24.700	104.425
11	30.585	30.225	31.170	11.412	11.200	11.500	11.000	24.700	102.750
18	31.440	30.930	31.875	11.500	11.300	11.500	11.000	24.700	103.425
25	31.565	30.150	31.095	11.500	11.300	11.500	11.000	24.700	102.850
CALENDAR WEEK AVERAGES									
Mar.									
6	29.730	29.730	30.675	11.112	10.900	11.500	11.000	24.700	103.575
13	31.125	30.425	31.370	11.500	11.300	11.500	11.000	24.700	103.000
20	31.760	30.905	31.850	11.500	11.300	11.500	11.000	24.700	103.425
27	31.395	30.005	30.950	11.500	11.300	11.500	11.000	24.700	102.562

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Mar. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
2	91.125	78.750d.	281.0320	249s. 6½d.
3	91.125	78.750d.	281.0700	249s. 5¾d.
4	91.375	78.750d.	281.0900	249s. 4¾d.
5	91.375	79.375d.	281.1200	249s. 5¼d.
6	91.375	79.375d.	281.0400	249s. 5½d.
9	91.375	79.375d.	281.1300	249s. 5d.
10	91.375	79.375d.	281.1100	249s. 4¾d.
11	91.375	79.375d.	281.1100	249s. 4½d.
12	91.375	79.375d.	281.1240	249s. 4¾d.
13	91.375	79.375d.	281.1833	249s. 4¼d.
16	91.375	79.375d.	281.2800	249s. 2¾d.
17	91.375	79.375d.	281.2600	249s. 2d.
18	91.375	79.375d.	281.3166	249s. 2d.
19	91.375	79.375d.	281.3333	249s. 2d.
20	91.375	79.375d.	281.3800	249s. 1½d.
23	91.375	79.375d.	281.3800	249s. 2d.
24	91.375	79.375d.	281.3950	249s. 2¼d.
25	91.375	79.375d.	281.4600	249s. 2¼d.
26	91.375	79.375d.	281.5000	249s. 2d.
27	Holiday	Holiday	281.5260	Holiday
30	91.375	Holiday	281.5300	Holiday
31	91.375	79.375d.	281.5860	249s. 1¾d.
AVERAGES FOR MONTH				
Mar.	91.351	79.281d.	281.271	——
AVERAGES FOR WEEK				
Mar.				
4	91.025	—	281.046	—
11	91.375	—	281.102	—
18	91.375	—	281.233	—
25	91.375	—	281.390	—

Calendar Week Averages: New York Silver: March 6, 91.275; March 13, 91.375; March 20, 91.375; March 27, 91.375.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.0400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy &Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

Mar.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
2	240¾	241	240½	240¾	70⅝	70⅞	71⅝	72	75½	75½	74	74¼	781	781½	783½	784
3	245¼	245½	244¾	245	70¾	71	71¾	72	75½	75⅝	74½	74¾	780½	781	784	785
4	246	246½	245¾	246	71	71¼	72⅜	72½	75⅝	76	74	74¼	779½	780½	782½	783½
5	247½	248	247	247¼	71⅛	71⅜	73	73½	76½	76⅝	74¾	74⅞	779½	780	783	783½
6	245	245½	244¼	244½	71	71⅛	72¼	72⅝	75⅝	76	74½	74¾	778½	779	781	781½
9	248	248¼	247¾	248	71⅛	71⅜	72⅝	73	75⅝	75⅞	74	74¼	776½	777	779	779½
10	248½	249	248¼	248½	71⅛	71¼	72½	72⅝	75¾	75½	74	74¼	779½	780½	782½	783
11	250	250½	249½	249¾	70½	70⅝	72¼	72½	76	76⅛	74½	74⅝	783	783½	787	787½
12	250¾	251	250¼	250½	69⅝	69⅞	71⅝	71⅞	75⅝	75⅝	74½	74¼	781½	782	785	785½
13	251	251¼	250⅛	250½	69¼	69⅝	71⅛	71⅝	73⅝	75½	74½	74¾	781	781½	874	784½
16	255½	255¾	252⅝	253	69½	69¾	71⅜	71⅝	75¼	75½	74	74¼	782	782½	785	785½
17	257½	257¾	255½	255¾	69⅝	69¾	71¼	71½	75⅝	76	74⅝	74¾	783	784	786	786½
18	254½	255	252	252¼	69¼	69½	71	71⅛	75½	75¼	74½	74¾	781½	782	784½	785½
19	250¾	251	248½	248¾	68⅝	69½	71	71⅛	75⅝	75½	74¾	74½	782	783	786	787
20	245¾	246	244¼	244½	69¾	69	70⅝	70⅞	75⅛	75½	74¾	74⅝	781½	782	785½	786
23	243	243¼	242½	242¾	67½	67¾	69½	70	74	74½	73½	73¾	779	780	782½	783
24	245	245¼	244¼	244¾	67¼	67⅝	69½	69⅝	73½	73⅝	73½	73¾	774	775	780	780½
25	247	247¼	246½	246¾	66⅝	66½	68⅝	68½	73¼	73½	72⅝	73	773½	774½	778½	779
26	246	246¼	246	246¼	67½	68	69½	69¾	73	73¼	72¾	73	775½	776	780	781
27	Holiday															
30	Holiday															
31	249¼	249½	249	249¼	65⅝	66	68¼	66½	72⅝	72¾	72⅜	72⅝	775½	776	780	780½
Av'g's	£248.513		£247.606		£69.513		£71.209		£75.122		£73.931		£779.738		£783.288	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated. tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

Feb. 28, 1959

Aluminum ingot, 99 plus % lb.		26.8¢
Antimony spot lb. less than carload, in cases		32.50¢
In bulk carload lots, f.o.b. Laredo		29.00¢
Imported, 10 ton min. (p), 99½%		24¢
Bismuth, ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.45
Calcium, lb., ton lots, 98%, cast		$2.05
Chromium, 97% grade lb. contract del.		$1.29
Cobalt 97 to 99%, per lb. eff. Feb. 1, 1957		$1.75
Germanium, per gram, 10,000 gram lots	(c)37¢ — (d)40.2¢	
Indium, troy oz.	$1.25 @	$2.25
Lithium, lb., 98%	$9.00 @	$11.00
Nickel, cathodes, lb. (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.		74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16		35½¢
Palladium, troy oz.	$18.00 @	$20.00
Platinum (wholesale lots), troy oz.	$75 @	$80
Quicksilver flask of 76 lb. 25 flasks or more	$232 @	$236
Selenium, 99 plus %, lb.—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		21½¢
Semi Conductor grade, lb.		$350
Tellurium lb.		$1.65
Thallium 100 lb. or more lb.		$7.50
Titanium 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62 @	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958.
(c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	(a) 28 @	(a)$30
	Term contracts $31–32.25	
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$19 @	$20
48% Cr_2O_3 3 to 1 ratio	$40 @	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi, non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$134.52
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra, $.915 @ $.965. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.15 @	$1.20
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra		$10.75–11.25
U. S. scheelite, f.o.b. mill	$19 @	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢
Zinc Ore Prime, 60% concentrate, Joplin, Mo., per ton		$64

(a) Nominal.
(e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.33 @	$1.36
Copper Sulphate, 100 lb. eff. Oct. 24 '58		$12.30
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46 @	$1.47
Imported, incl. 37¢ duty	$1.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr (4-9% C)		28¾¢
Ferromanganese, 74 to 76% per lb., ship. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50 @	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)		14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovanadium, per lb. of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,400 @	$1,810
Crude No. 2	$750 @	$1,155
Spinning fibers	$370 @	$600
Shingle fibers	$180 @	$220
Paper stock	$120 @	$145
Waste	$75 @	$86
Shorts	$40 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$220 @	$787
Asbestos, Vermont, f.o.b. Morrisville:		
Spinning fibers	$370 @	$428
Shingle stock	$181 @	$200
Paper stock	$120 @	$152
Waste, stucco or plaster		$86
Refuse or Shorts	$41 @	$75
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st.	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00 @	$5.50
Domestic, chemical 55 to 58%	(c)$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00 @	$18.50
Imported metallurgical, per lt. f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade		$20.50–$21
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap, $20 @ $30.		
Ocher, Georgia, ton in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30 @	$5.50

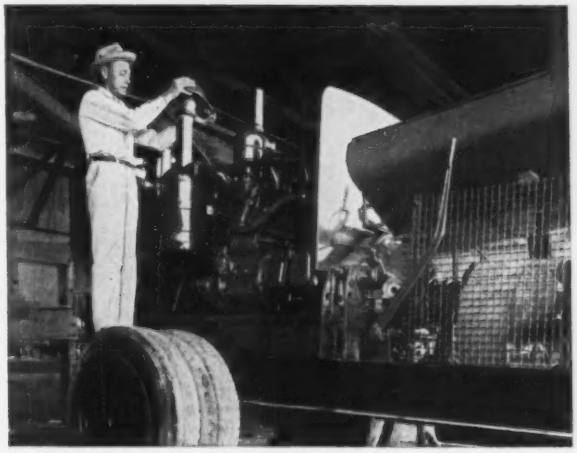
ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

FIRM M. M. SUNDT CONSTRUCTION CO. Tucson, Arizona

RPM DELO OIL ends 5 years of engine troubles

The pan has never been off the Caterpillar D7 engine of this Link-Belt Speeder shovel in 7 years, using RPM DELO Oil. Only repair was a single valve job—no other parts replaced. William Naumann, Sundt's Operations Manager, says, "We tried nine different major brands of oil in five years, trying to lick the frequent breakdowns that slowed our operations. Sometimes, main and rod bearings even froze solid on the crankshaft. We changed to RPM DELO Oil seven years ago, and, since then, have never had any engine troubles due to oil failure. We now use RPM DELO Oil exclusively in our 22 heavy-duty engines."



Lubricated with RPM DELO Oil, this Caterpillar D 13000 portable unit powered a rock crusher of M. M. Sundt Construction Co. for a total of 8976 hours before overhaul. "In spite of extremely dusty conditions the only time the engine was touched was to replace a head—no other repairs were necessary," reports master mechanic Billy Gray, shown replacing air cleaner on unit following overhaul.

Austin 101 rock crusher, powered by Caterpillar unit described above, works 20 hours a day at firm's materials stockpile outside Tucson. Company works year around on road paving, grading, foundations, building construction.

Why RPM DELO Oils reduce wear —prolong engine life

● Oil stays on engine parts—hot or cold, running or idle ● Anti-oxidant resists lacquer formation ● Detergent keeps parts clean ● Special compounds prevent corrosion of bearings ● Inhibitor resists crankcase foaming

LUBRICATING OILS RPM DELO

For More Information about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.

TRADEMARK "RPM DELO" AND DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

These steels do cost more—

USS "T-1" Steel lightens world's largest drag bucket.

This 35½-yard dragline bucket – the world's largest – was recently built by the Electric Steel Foundry Company, Danville, Ill. It will be used in the Central Ohio Coal Company's open pit operation near Zanesville, Ohio. The big problem was to obtain the desired capacity, strength and ruggedness with the least possible weight. To do this, the builder used super-strength USS "T-1" Constructional Alloy Steel plate in the sides, bottom and back. No other steel would provide such high yield strength (100,000 psi), weldability, and resistance to impact abrasion.

The completed bucket scoops 106,000 pounds of load but weighs only 69,000 pounds. Of this, 8,500 pounds are USS "T-1" Steel and 12,000 pounds are USS MAN-TEN High-Strength Steel, which has a minimum yield point of 50,000 psi. The weight saved by these two steels goes into extra load capacity and results in lower costs per cubic yard moved.

but they do more — and save more!

Today's mining equipment is the biggest, toughest and brawniest ever built. Much of its ruggedness and long life come from high-strength steels, new grades of super-strong, super-tough alloy steels, and stainless steels. *Special steels make the difference.* Today's special steels for mining equipment are stronger—tougher—more resistant to abrasion and corrosion. Every pound of these steels in your equipment means money well spent. Money that pays dividends by cutting dead weight, increasing payload, extending service life, reducing downtime and saving operating dollars. *USS, Cor-Ten, Man-Ten, Tri-Ten and "T-1" are registered trademarks*

Here are the USS Steels that do more:

USS MAN-TEN Steel—High-strength with abrasion resistance and economy. (Minimum yield point 50,000 psi)

USS COR-TEN Steel—High-strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi)

USS TRI-TEN Steel—High-strength with toughness, weldability and abrasion resistance. (Minimum yield point 50,000 psi)

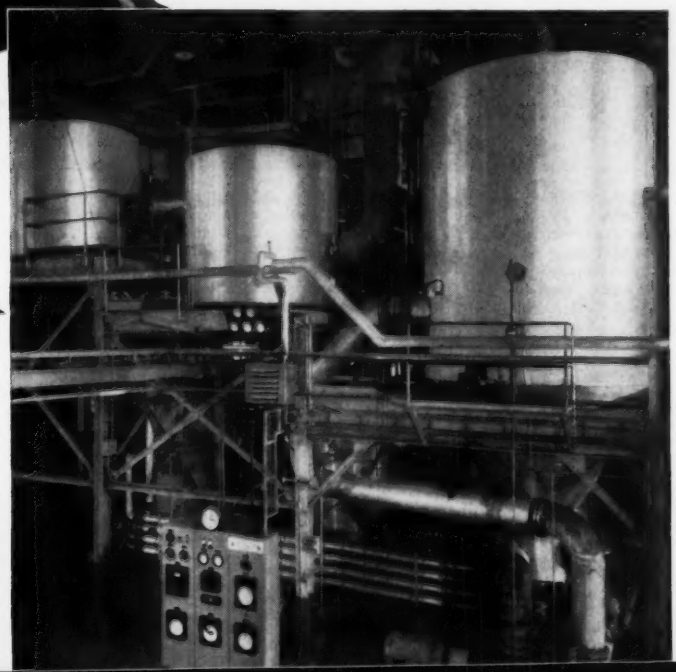
USS "T-1" Steel—Super-strength with impact abrasion resistance, weldability and toughness. (Minimum yield strength 100,000 psi)

USS STAINLESS Steel—High resistance to corrosion, elevated temperature and abrasion.

Each of these USS Steels is superior for certain applications. Our metallurgists will help you choose the best steel for your job. Contact our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS MAN-TEN Steel helps cut haulage costs.

This 50-ton Dart coal hauler operates at a rate of 5.9¢ per ton-mile. The old, smaller trucks cost 12.6¢ per ton-mile. These figures include truck operation, truck maintenance and other costs. Contributing substantially to the lower operating rate was the use of USS MAN-TEN High-Strength Steels which enabled the construction of larger trucks having 15% greater capacity than conventional units. In three years' time, no maintenance was required on the new trucks due to USS MAN-TEN Steel's high resistance to abrasion and impact.



Only Stainless Steel is good enough for this new extraction process.

Sheritt Gordon Mines, Ltd., Fort Saskatchewan, Canada, has a new method for extracting nickel, copper and cobalt from ore. The ore is dissolved in a bath of ammonium sulfate and ammonia and the metals are recovered from solution. Stainless Steel is the only metal that can be used in the pipes, tanks and pumps that give the "hot bath" of ammonium sulfate to the ore. Other materials can't take the corrosion and high temperatures in this work as well. Stainless has proved more economical than any other metal.

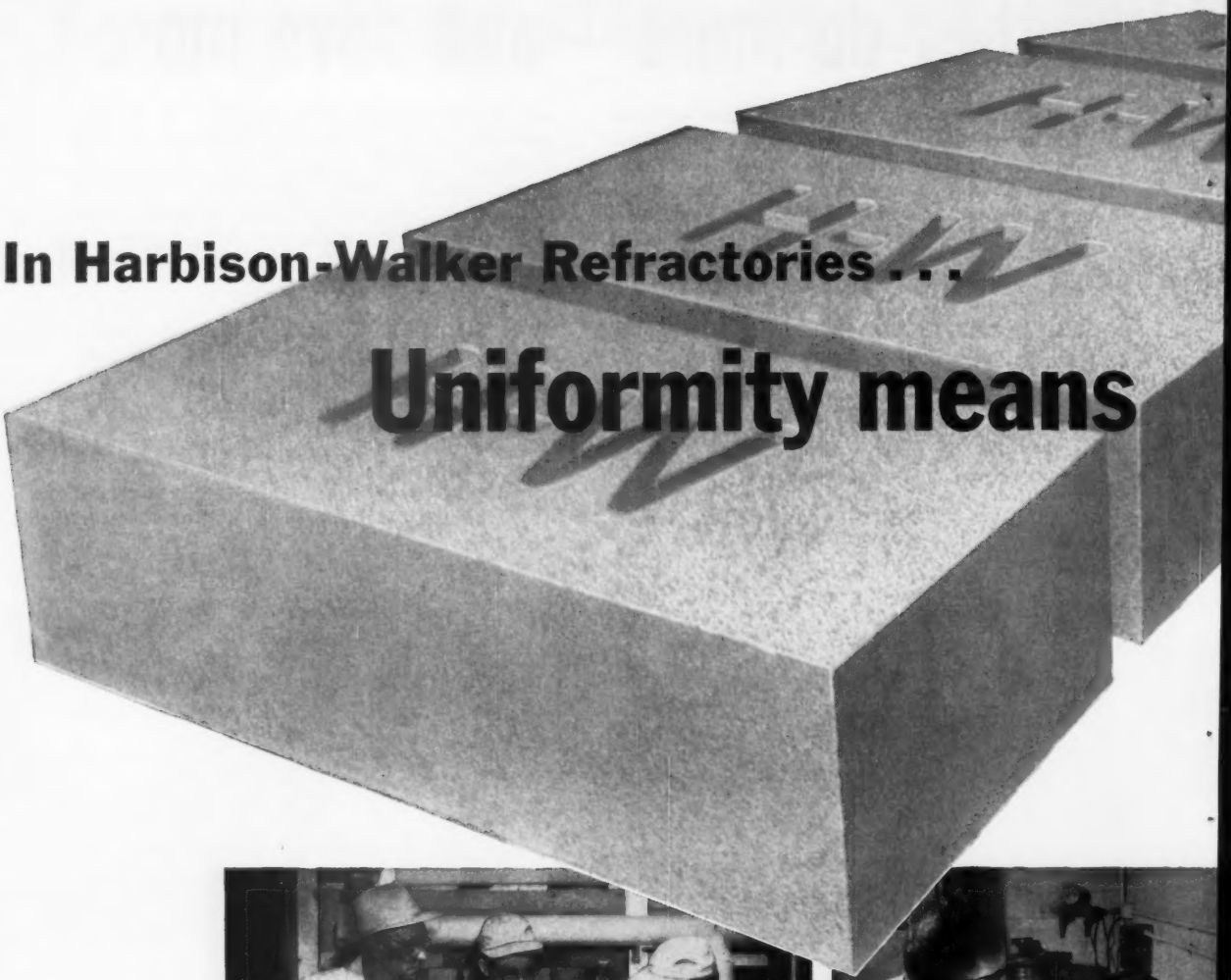
United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

USS

In Harbison-Walker Refractories . . .

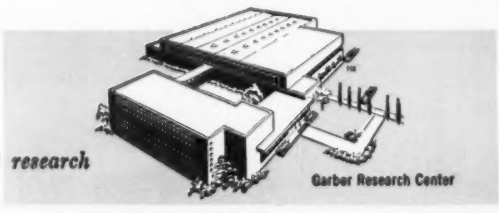
Uniformity means



CONTROL OF QUALITY IN RAW MATERIALS—Representatives of Mining Department and Control Engineer examining lumps of flint clay after test firing. On the basis of this and other preliminary tests, clays are blended to obtain mixtures having desired properties.

CONTROL IN RAW MATERIALS PREPARATION—Screen analyses of brick mixtures keep the proportions of the various size fractions within predetermined limits. This correct proportioning is important to uniform performance of the refractory.

Leadership in refractories
through constant ***research***



Garber Research Center

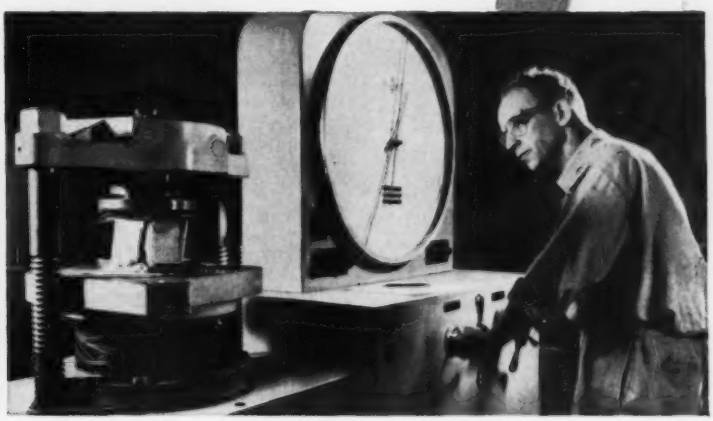
Consistent Performance

The dependable uniformity and high quality of Harbison-Walker refractories assures predictable and consistent performance and permits users to plan furnace campaigns with confidence. Through a highly developed system of Quality Control, Harbison-Walker is able to compensate for normal variations and to produce refractories having the highest degree of uniformity in quality and workmanship so important to satisfactory performance.

The results are: better furnace operation, fewer interruptions, lower maintenance costs.

Control testing begins with the raw material still in the ground, follows through each stage of mining, processing and manufacturing, and ends only when the finished products are loaded on cars or trucks for shipments to the user.

CONTROL IN MANUFACTURE—Batching and mixing, pressing and forming and drying and firing—all important steps in manufacture—are constantly checked. Periodically, a supervisor weighs and measures samples of the brick being made. By means of control charts, acceptable limits, both upper and lower, can be closely maintained.



PRODUCT TESTING—Tests are made continuously on samples of finished refractories to make sure that they meet the Harbison-Walker standards. These include crushing strength (shown here), resistance to abrasion, high temperature characteristics and other physical properties.

HARBISON-WALKER
REFRACTORIES COMPANY
AND SUBSIDIARIES
World's Most Complete Refractories Service
GENERAL OFFICES • PITTSBURGH 22, PENNA.

One of Mr. Janney's Macks leaving the phosphate mine with a load of ore. The haul road drops 2,000 feet in the five miles from the mine to the unloading site. The mine (operated by the Utah Construction Co.) is located near Garrison, Montana, at an elevation of 6,000 feet.

When it's a matter of profitable hauling...

The smart money rides on MACKS!

"Not only phosphate ore rides on our Macks—so do our profits," says Mr. W. P. Janney, of Garrison, Montana.

"Our Mack trucks constantly operate on excessively steep grades, during a working season limited to seven months per year because of snow. Yet they keep an on-time schedule, with little down time and low operating costs. That's why we're putting in an order for more Macks. When it comes to profitable hauling, we put our money on Macks!"

There's a good reason why hauling costs hit rock bottom when Mack trucks handle the job. Macks are quality-built from front bumper to rear axle; rugged major components —front and rear axles, frames, brakes, transmissions and engines— are built to the highest standards in the industry, in Mack's own factories . . . your assurance of trouble-free, economical operation, year after year.

Mack specializes in solving difficult hauling problems. Get in touch with your Mack branch or distributor, and ask to have a specialist in profitable hauling call on you—soon. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
FIRST NAME FOR
TRUCKS

take it

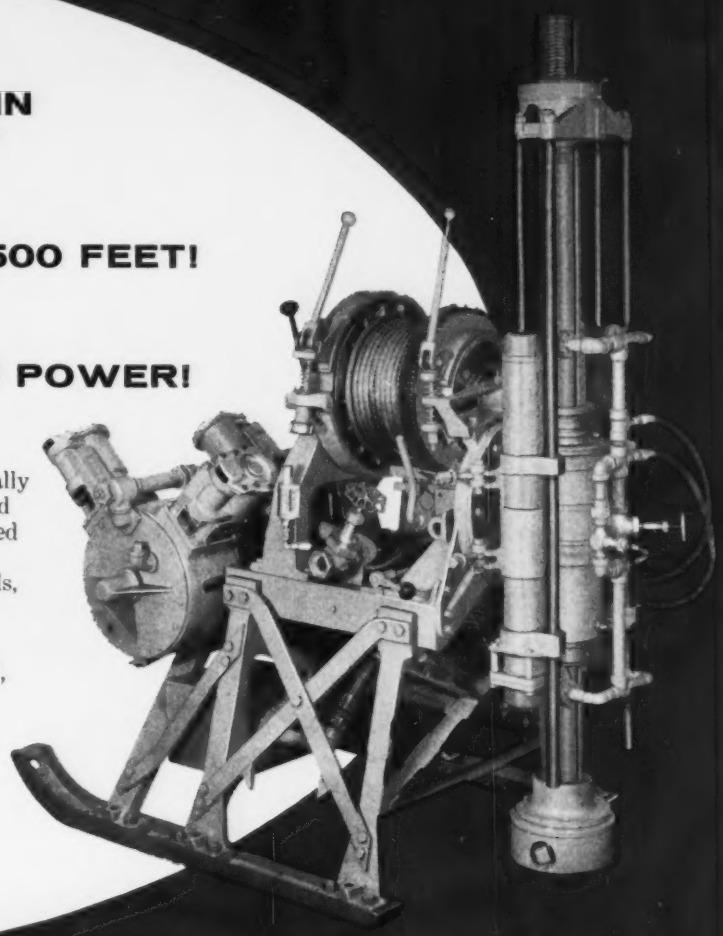
UNDERGROUND IN A 5-FOOT CAGE!

drill

HOLES UP TO 3500 FEET!

move it

UNDER ITS OWN POWER!



Here's an air-powered drill specifically developed for DEEP underground diamond drilling. It has a four speed transmission and optional hydraulic or gear feed swivelheads, which will pass up to 3½" O.D. tubing, for large hole drilling.

Model BBS-2UG, less swivelhead, can be moved from level to level inside a 5 foot cage and can be moved under its own power in drifts or crosscuts, where mine tracks have been removed. It can be easily dismantled into sub-units, when necessary.

BBS-2UG

WE LOOK INTO THE EARTH

BOYLES BROS
DRILLING COMPANY LTD.
VANCOUVER, CANADA

SPECIFICATIONS

Rated depth capacity - -	AX	3500 feet
	BX	2400 feet
	NX	1950 feet
Net weight range - - -	1865 to 2495 lbs.	

Write for Bulletin No. BB-44

57-70

BOYLES BROS. (PTY) LTD., JOHANNESBURG, SOUTH AFRICA • BOYLES BROS. DRILLING CO. LTD., NEWCASTLE-ON-TYNE, ENGLAND • ATLANTIC, GULF AND PACIFIC CO. OF MANILA, PHILIPPINES • SHRIRO TRADING CO. S.A. TOKYO, JAPAN • FORMAC S.A. RIO DE JANEIRO, BRAZIL • WEISE AND CA. LDA., LISBON, PORTUGAL • CIA. DIAMANTINA B.H. S.A. LIMA, PERU • R.I.E.G.A. BUENOS AIRES, ARGENTINA • HAEHRE AND CO. A/S. OSLO, NORWAY • INTERNATIONAL MACHINERY CO., SANTIAGO, CHILE • DIMITRY SCALISTIRI, ATHENS, GREECE • TRILLIANCE ENGINEERING CO., NEW DELHI, INDIA. • BOYLES BROS. (PTY) LTD., KITWE, NORTHERN RHODESIA •

Speeding the "Age of Aluminum"

Recently completed additions to the Sherwin Alumina Plant of Reynolds Metals Company again spotlight the major expansion program undertaken by the company to provide the extra capacity which will stimulate more—and wider—uses of aluminum.

The plant, located at Corpus Christi, Texas, processes bauxite to extract the alumina from which aluminum is produced. Two new processing units have doubled its potential output—providing a capacity of more than 700,000 tons of alumina per year.

Corpus Christi Plants of Reynolds Metal Company. Capacity of plant in foreground has just been doubled.

In addition to engineering and constructing the Sherwin plant expansion, Bechtel is now at work on Reynolds new St. Lawrence River Reduction Plant at Massena, New York. This is a "turnkey" project under single responsibility.

BECHTEL CORPORATION

Engineers and Builders for Industry

SAN FRANCISCO • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED • TORONTO

KILL THE STEPS ...NOT THE MAN

CHECK THE NEW

Connellsville MINICAGE

(TRADE MARK)

A First in Service Elevators for Preparation Plants

REDUCES DOWN TIME . . . ELIMINATES FATIGUE . . . SPEEDS MAINTENANCE

Yes, the Connellsville MINICAGE is truly the first of its kind! Here is an elevator that provides fast, easy service economically . . . automatically! What's more, initial cost and installation is surprisingly low.

The Connellsville MINICAGE is designed to travel on the outside wall of an existing preparation plant or on the inside of future-planned facilities. Saves time and labor . . . moves automatically from floor to floor. Reduces non-productive manhours caused by fatigue and early "knock-offs" . . .

The all-steel cage, with its pantograph-style gate, has a capacity of 1000 lbs. and up. It operates at speeds of 50 to 75 feet per minute. Safety mechanisms are operated by governor rope.

The sturdy fabricated steel structure of the MINICAGE is mounted in place, and safely attached to the wall. Wall openings at each level are protected by hinged safety doors.

Drive assembly of the MINICAGE is installed at the top of the structure and is coordinated with the cage and level doors by a control system. The entire MINICAGE installation complies with federal and state mining laws.

For additional information and details about the Connellsville MINICAGE, write for Bulletin No. M559 to Connellsville Manufacturing and Mine Supply Company, Connellsville, Pa.

Raising Production
SINCE 1901
Connellsville MANUFACTURING

NOW! FOUR JALLOY

HEAT-TREATED, ABRASION-RESISTANT

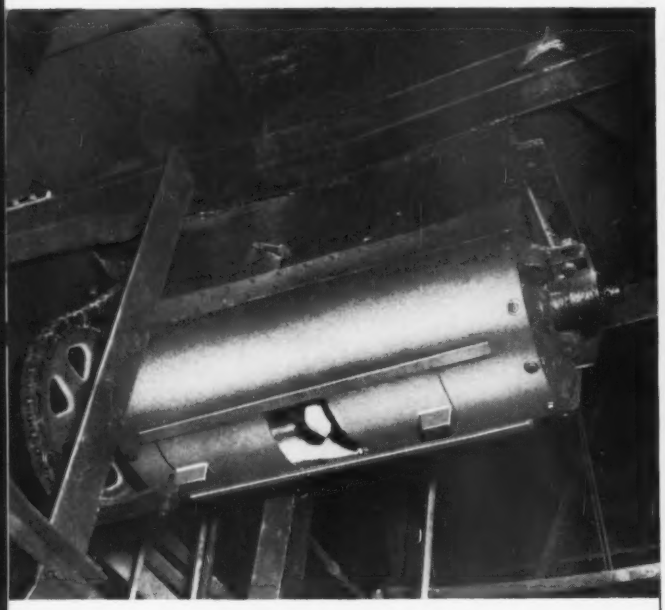
The new Jalloy series includes four types designated by suffix numbers,

JALLOY 280 **(Brinell range 260/300)**

Has excellent low temperature impact properties. Can be bent across the width (axis of bend at right angles to direction of rolling) on a brake press or on roll forming equipment. Where forming with the axis of bend parallel to the final rolling direction, Flange Quality can be supplied on application. Recommended minimum inside radius is 2t (t = plate thickness) up to ½" inclusive in thickness and 3t over ½" in thickness.

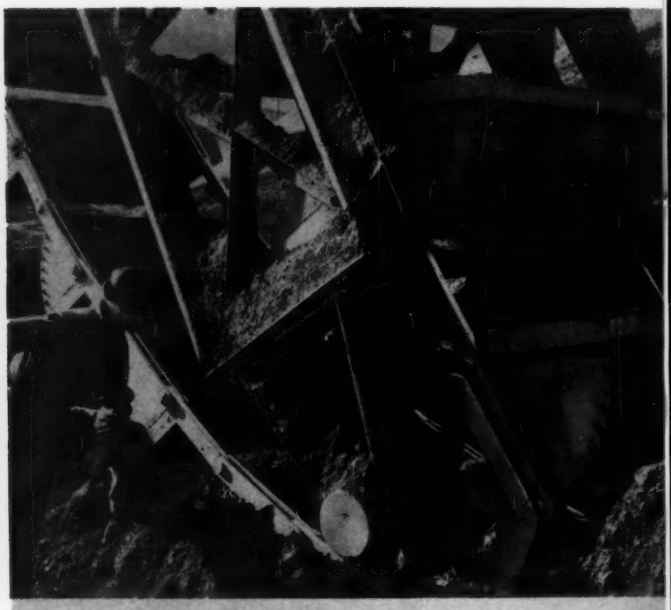
JALLOY 320 **(Brinell range 300/340)**

Has improved abrasion resistance over Jalloy-280. Can be bent across the width (axis of bend at right angles to direction of rolling) on a brake press or on roll forming equipment. Where forming with the axis of bend parallel to the final rolling direction, Flange Quality can be supplied on application. Recommended minimum inside radius is 3t (t = plate thickness) up to ½" inclusive in thickness and 4t over ½" in thickness.



JALLOY-280

In this cement agitator bottom saves time and money in maintenance. Jalloy offers low initial cost. And, it lasts six times longer than structural carbon steel.



JALLOY-320

Is used in these round-bottom scoops for its formability and abrasion resistance, which effect savings in manufacture and operation.

The JALLOY series will best meet your requirements for:

Abrasion resistance • Atmospheric corrosion resistance
Impact resistance • Forming properties

All at minimum cost to attain proven results

HARDNESS RANGES

PLATES FOR LONGER WEAR, LESS REPAIR

representing the mean of Brinell hardness range, and by color code for easy identification.

JALLOY 360 **(Brinell range 340/380)**

Has excellent abrasion-resistant properties. For best results in welding all Jalloy ranges, a low-hydrogen AWS Spec. E 100 XX Series is recommended. Preheating and postheating are not normally required but are sometimes used in special designs to avoid concentrated stress conditions. When preheating or postheating in those cases, a range of 200/400° F. is recommended.

JALLOY 400 **(Brinell range 380/420)**

To be used for flat applications. This type has maximum abrasion resistance. All Jalloy hardness ranges are furnished only in the heat-treated condition because the chemical composition of alloy steels alone does not provide the optimum physical properties. Uniformity of strength, hardness and toughness are achieved by close temperature controls during heat treating operations.

JALLOY-360

Jalloy-360 in the bottom, and Jalloy-400 in the runners, give this dump body resistance to the impact of loading, and the abrasion of dumping aggregate materials.

JALLOY-400

Lasts three times as long as mild steel in this particular application. Aprons in these screens are subjected to severe abrasion from sliding 1-inch granite.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

STEEL

FIELD REPORTS PROVE SUPERIOR PERFORMANCE OF NEW BOSTON BELTS

DIGEST OF PERFORMANCE FIGURES FOR 1296 BELTS*

44% increase in consistency of tensile strength

6% increase in tensile strength

130% improvement in consistency of elongation

* Compared to belts previously manufactured

HERE'S WHAT DOES IT!

The startling figures above are a direct result of two major belt manufacturing advancements — both developed by, and exclusive with, Boston Woven Hose & Rubber Co.

ADVANCEMENT #1 **BALANCED BELT CONSTRUCTION** for the first time equalizes ply stress so that each ply pulls its full share of the load. **BBC** eliminates lazy plies. A BOSTON exclusive because only BOSTON can combine Electronic Tension Controls with Rotocure, the continuous method of vulcanization, which assures uniformity throughout the belt.

ADVANCEMENT #2 **DULON** markedly improves the aging characteristics of BOSTON belts. An exclusive BOSTON research development, the tough specially treated cover compound stays resilient longer . . . makes the belt much more resistant to abrasion, gouging, tearing and oxidation.

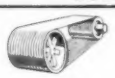
BALANCED BELT CONSTRUCTION plus **DULON** add up to longer belt life . . . less trouble in service . . . greater economy.

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.

INDUSTRIAL HOSE

BELTING


V-BELTS

PACKING

MATTING

TAPE

A-C ALLIS-CHALMERS

metal mining modernization

Modernization starts with this booklet

"Work Index" formula detects inefficiency... prevents misapplication

Engineers call it the Third Theory of Comminution. This "Work Index" formula offers the only scientific method of determining equipment size and horsepower requirements. Used in your modernization planning, it will detect inefficiencies in your present setup — facilitate compiling application data — indicate type and size of equipment. Ask for Bulletin 07R7995. *See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.*

Only Allis-Chalmers builds both processing machinery and electrical equipment. Out of this diversity has come the unique ability to coordinate machines and equipment for your entire operation.

ALLIS-CHALMERS

A-5990-MM

Modern "One-Hoss Shay"

Remember "The Wonderful One-Hoss Shay"? It ran for 100 years, each part wearing so evenly with the others that all disintegrated at the same instant!

Uniformity of wearing qualities is a key characteristic of Morris Pumps. Witness the worn-out impeller from a Morris Type K pump at right. The vanes are uniformly worn to less than ½" thickness. The suction shroud is completely gone, except for a paper-thin portion little larger than a hand.

Yet the retention of original vane contour maintained hydraulic performance at normal levels, so that only a routine overhaul revealed the extent of overall wear.

Durability and dependability over the long pull are the *normal achievements* of Morris Pumps. They are the result of proper design backed by superior materials, careful engineering, and fine workmanship.

• Why not call on our engineers for qualified recommendations of pumps you can depend on for years of uninterrupted service.

MORRIS
CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS BALDWINSVILLE, N.Y.

SALES OFFICES IN PRINCIPAL CITIES • EXPORT OFFICE: 50 CHURCH ST., NEW YORK 7, N. Y.

metal mining modernization

New ROM screen shakes off brutal battering

Designed to team up with primary crushers to handle toughest jobs in any metal mining flow

There's an Allis-Chalmers screen for every metal mining application

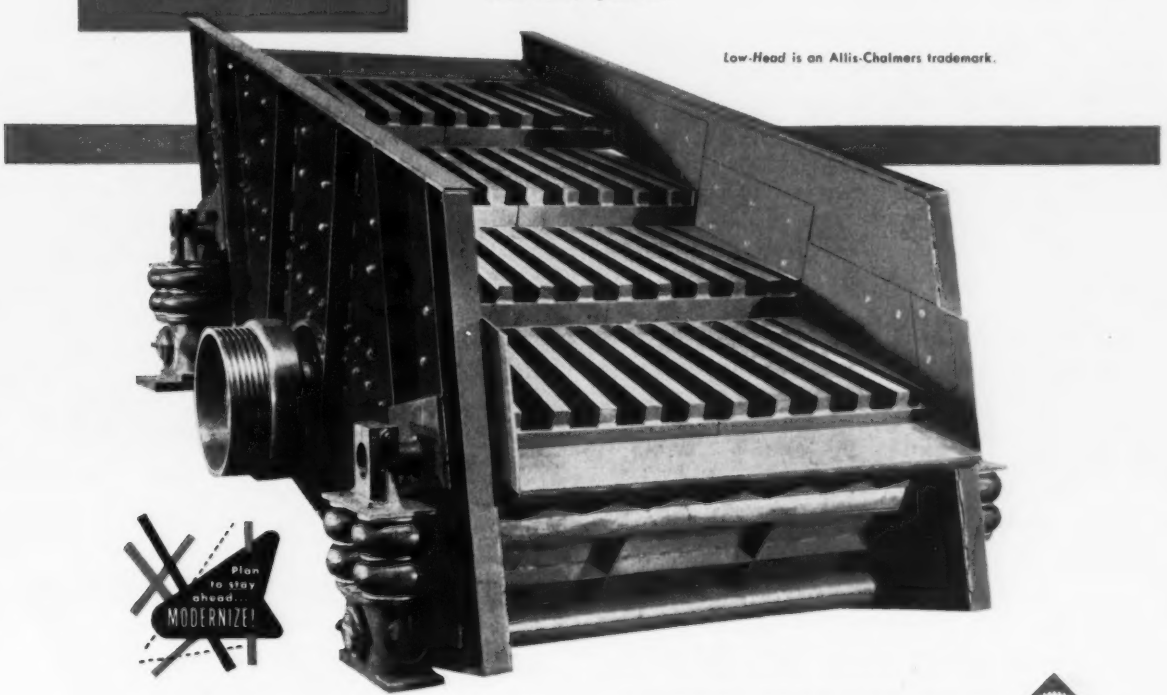
A complete line of inclined screens for scalping, sizing and cyclone plant application; plus the industry's most popular screen — the Low-Head horizontal screen for pre-wetting, washing and sizing, media recovery.

Large volume requirements . . . single pieces of ore weighing as much as four tons . . . such are the demanding conditions under which this screen is setting new performance standards.

Built for heavy-duty service, its husky support frame ignores persistent pounding. Its giant bearings are designed for long life. And even if hundreds of pounds of sticky material cling to its body, this *extra heavy duty* screen still performs efficiently. Vibration isolation is handled effectively by either air springs or steel coil springs.

For complete information, see your Allis-Chalmers representative or write for Bulletin 07B8368, Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

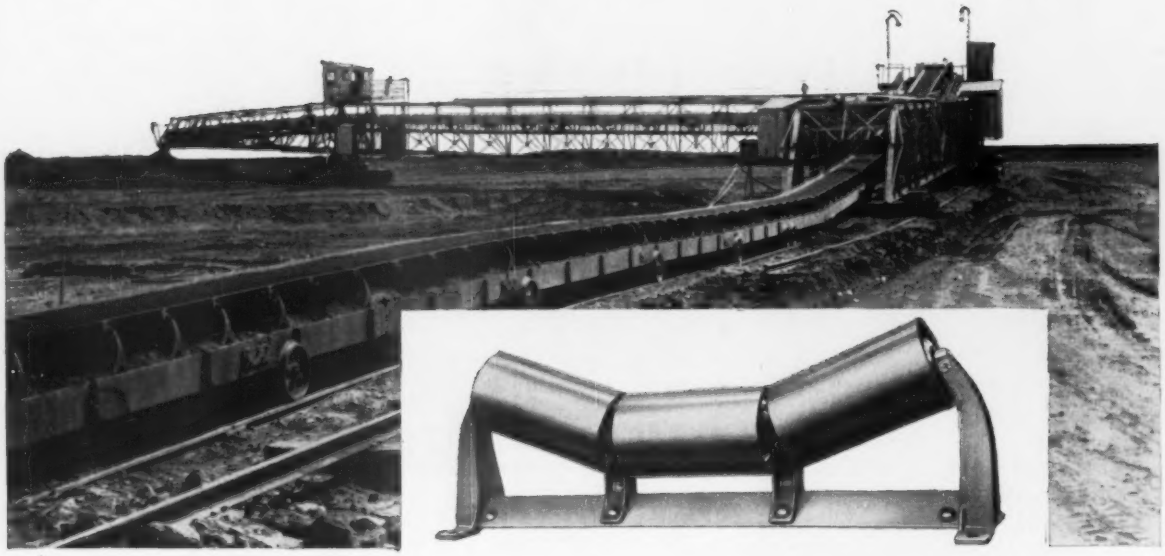
Low-Head is an Allis-Chalmers trademark.



ALLIS-CHALMERS

A-5941-MM

New-type idlers on old conveyor stretch greasing intervals to years



▲ Three-mile conveyor has 48" belt, carrying capacity of 1800 yards per hour at 675 feet per minute.

Jeffrey **PERMASEAL®** Idler

30 million yards of overburden since 1948
10 million more on this job...
M. A. Hanna, Pierce Mine, North Hibbing, Minnesota

Removal of 2,700,000 yards to date has required a mile of new conveyor sections, extending the entire system over three miles of hilly Minnesota terrain.

Jeffrey PERMASEAL® Idlers are installed as original equipment in the new sections, as replacement idlers in the old sections.

PERMASEAL'S unique double seal design protects bearings as they have never been protected before, stretches greasing intervals from months to years – slashes direct and indirect costs. At M. A. Hanna and many other companies, PERMASEAL® Idlers are proving their ability to outlast any other idler on the market.

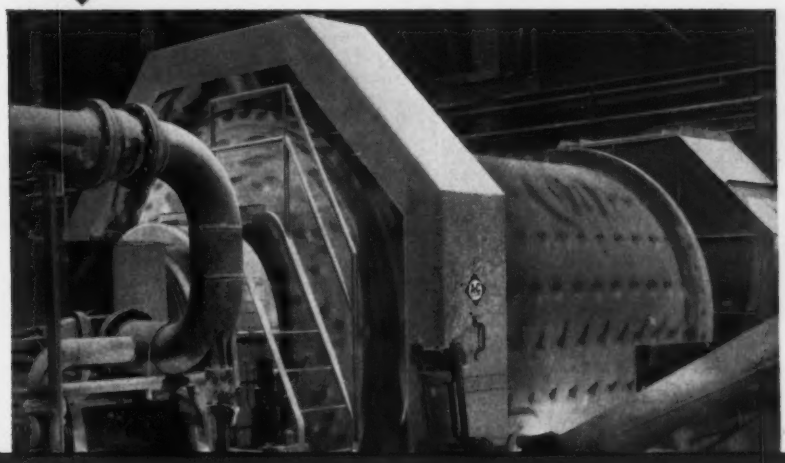
Your materials-handling supervisor should have our new Catalog No. 909 on belt conveyors. It has valuable design and descriptive data. Contact a Jeffrey distributor, or write The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

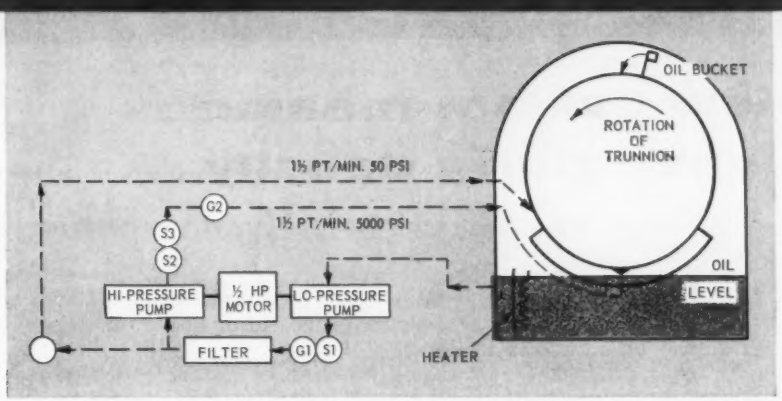
JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

A-C ALLIS-CHALMERS

metal mining modernization





Floating start, ride and stop for big mills

New Lubritrol system provides constant lubrication for trunnion bearings

Plan to stay ahead... MODERNIZE!

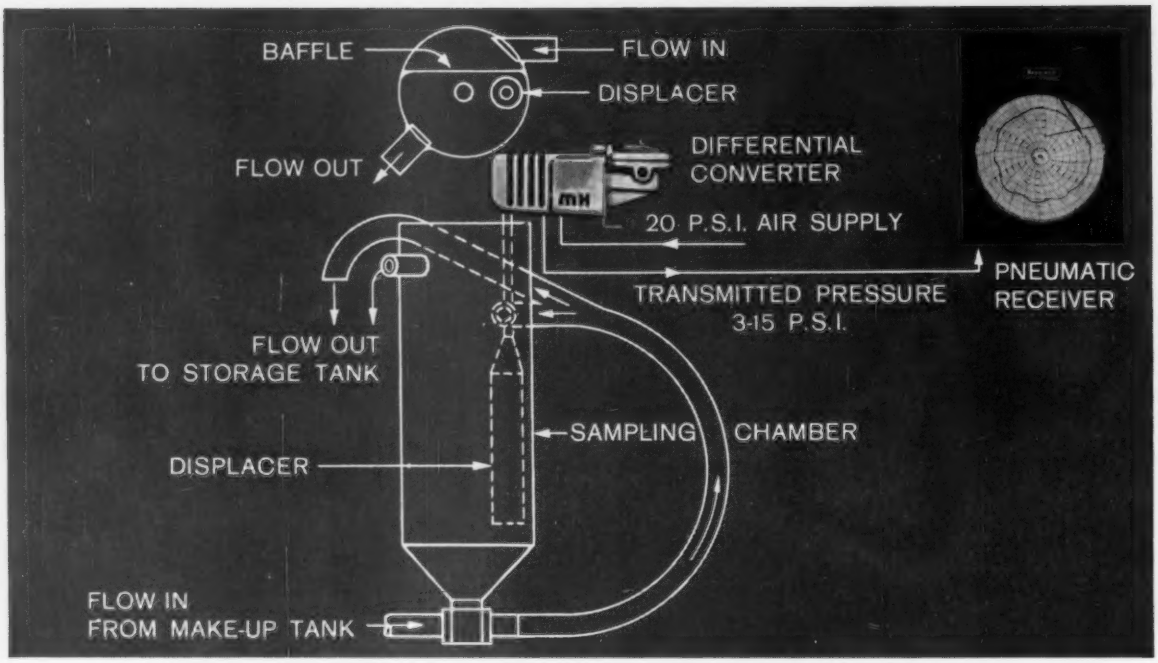
Volume producers throughout the metallic mining industry are taking advantage of the cost-cutting, space-saving advantages of big grinding mills. When *you* modernize with a bigger mill insist on Allis-Chalmers — the only mill that gives you the positive protection and maintenance economy of *Lubritrol* constant lubrication. These new and bigger mills actually *float on oil*. No bearing-wearing starts. Less wasted horsepower. All functions of the *Lubritrol* system are automatic . . . controlled by foolproof pressure gages and switches.

There's an expert in your nearby A-C office ready and willing to help. Or drop a line to Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

Lubritrol is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5934



New system measures heavy slurry density . . .

simply, accurately, economically

This Honeywell system eliminates the high cost of radioactive methods and the difficulties of air bubble tube systems for measuring heavy slurry density. It is a simple, accurate displacer system.

A displacer, precisely calibrated for a specific density range, is connected to a *Differential Converter* to provide the density signal. This signal is transmitted to a receiving indicator, recorder, and/or controller.

The sampling chamber is designed to maintain the level of a truly representative sample of slurry so that the displacer is kept completely immersed. There's no clogging or build-up of solid material at the bottom of the chamber. Violent pumping surges are eliminated. Necessary circulation is maintained, so that slight changes in slurry density from the make-up tank are immediately sensed by the displacer and transmitted to the pneumatic receiver.

Honeywell supplies the entire system, including the sampling chamber. It is a sensitive, stable and trouble-free means of measurement, and permits the ready addition of conventional controls. Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

First in Control

A-C ALLIS-CHALMERS

metal mining modernization

Allis-Chalmers tackled this motor problem "cold"

EVEN heavy icing couldn't freeze this motor. An Allis-Chalmers customer required that this open-type *Super-Seal* motor (with *Poxeal* insulation) start even though embedded in ice.

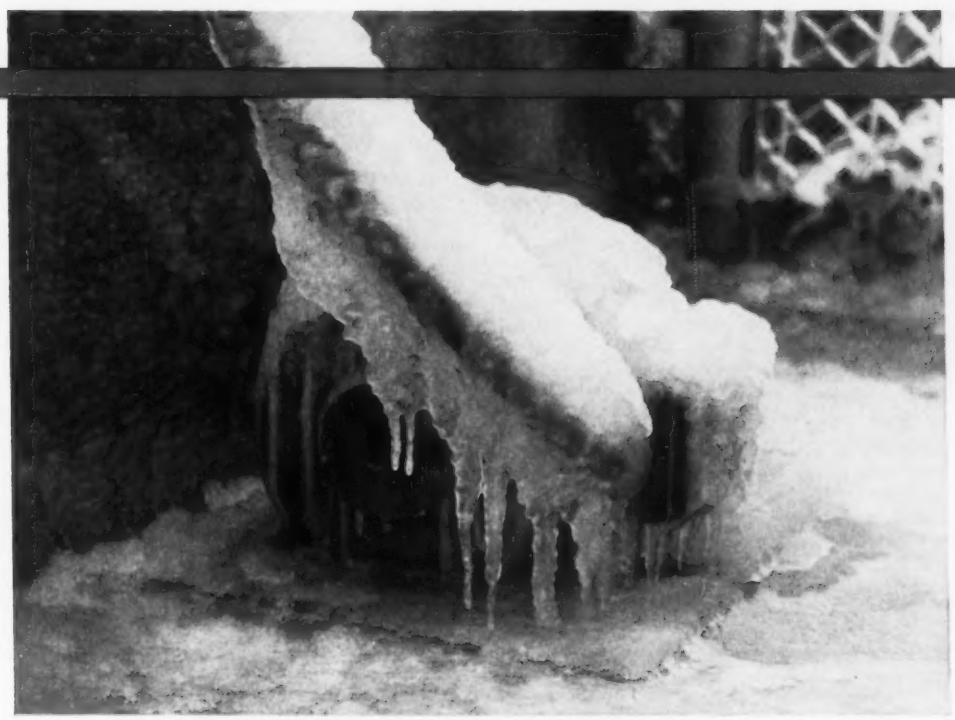
The successful tests were conducted in the A-C Motor Laboratories where customers' motor needs point the way to continuous development programs.

Research, combined with testing of this type, has established Allis-Chalmers as a pioneer-leader in the motor industry. It has led to the most complete line of integral-horsepower motors; it has led to tremendous acceptance of such A-C developments as *Synduction* and tube-type motors, and now *Super-Seal* motors.

Your metal mining *operations can benefit from this pioneer-leadership by contacting your A-C representative or distributor, or by writing Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.*

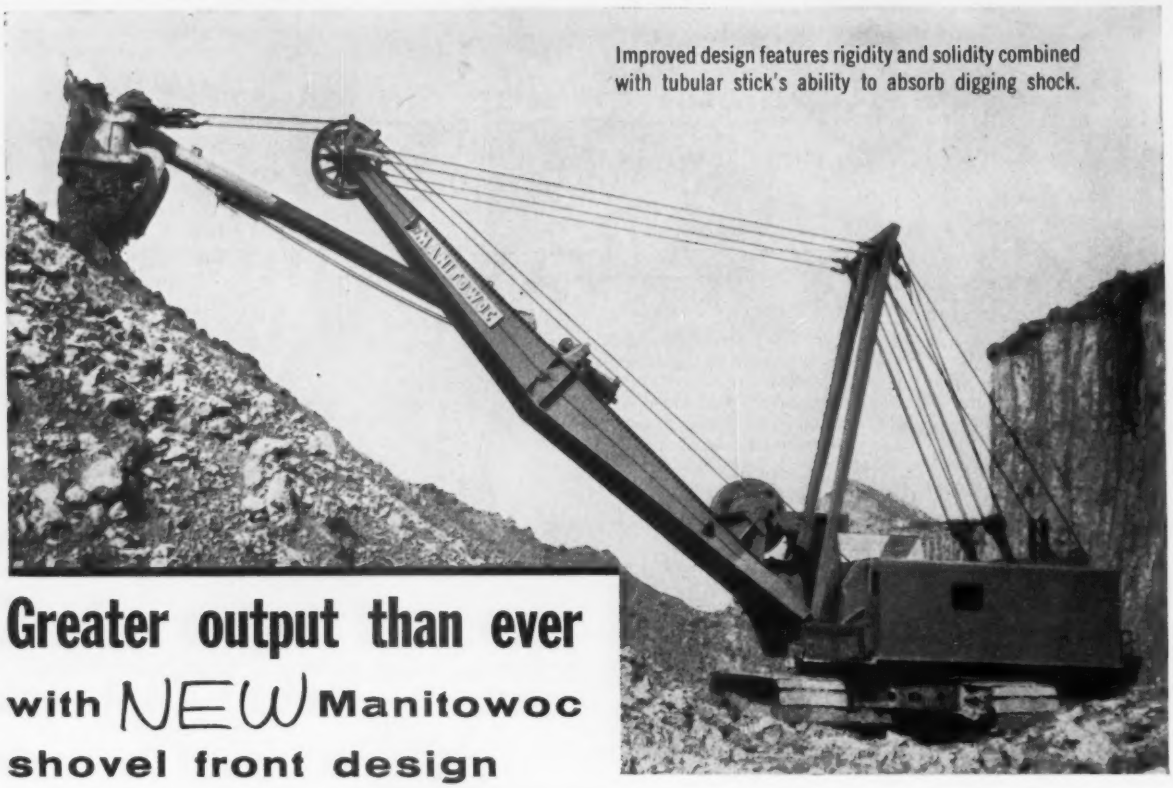
Poxeal, Synduction and Super-Seal are Allis-Chalmers trademarks.

Plan to stay ahead... MODERNIZE!



A-C ALLIS-CHALMERS

A-5956MM



Improved design features rigidity and solidity combined with tubular stick's ability to absorb digging shock.

Greater output than ever

with NEW Manitowoc shovel front design

- *Better digging action*
- *Direct hoist power*
- *Absorbs impact shock*
- *50% less cable wear*

Now the powerful Manitowoc Model 4500 5½-yd. shovel combines an improved method of dipper suspension and direct application of hoist power to give you faster and better digging action . . . increased production . . . longer machine life.

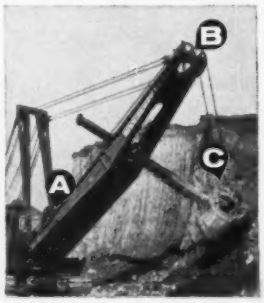
DIRECT HOIST POWER. Two short cables, powered by a double-drum spool mounted on the boom base, are separately reeved through each boom point sheave and are attached directly to swivel sockets at the outside corners of the dipper bail. Power transmission is simple and direct, eliminating long cables and frequent sharp bends. Cuts your maintenance costs and down time.

STABLE DIPPER SUSPENSION. With hoist cables attached to each side of the bail, and the bail block eliminated, you get widespread support of the dipper, added rigidity and stability in tough digging . . . yet you retain the shock absorbing features, resiliency and flexibility that tubular dipper stick design provides. You can still handle a rock too big to go through the dipper—simply lift it to the top of the spoil pile and as soon as you put slack in the hoist cables, the dipper will turn sideways and "spill" the rock.

In addition, you get better bucket penetration and loading with less spillage because all linkages are in line, and the bucket is more stable in every phase of the crowd, hoist and swing cycles.

To get complete information on the all-new Manitowoc shovel front end design, ask your distributor for a copy of Form No. 23-58 or write to Manitowoc Engineering Corp. for full details.

Here's How It Works: Hoist power is transmitted by heavy cable from the shovel main front drum over the center of a large "Secondary" hoist drum (**A**) mounted at the base of the boom. Cables are rigged from each of the spools on the secondary hoist over the boom point sheaves (**B**) and tied directly to heavy duty swivel sockets on each side of the bail (**C**). The hoist power flow is direct and simple, without sharp cable bends.



Manitowoc

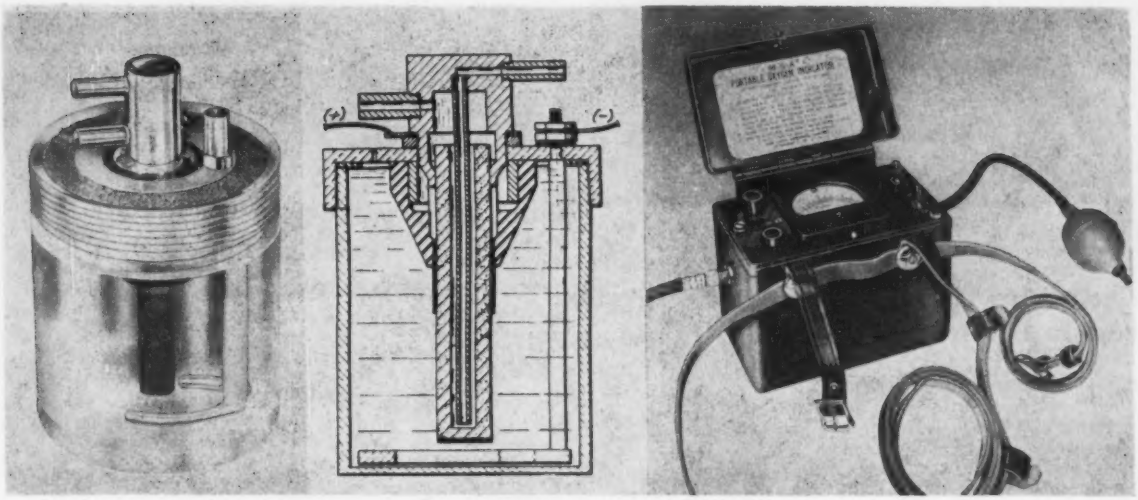
MANITOWOC ENGINEERING CORP.

(A subsidiary of The Manitowoc Company, Inc.)

MANITOWOC, WIS.

SHOVELS 1¼-yd. — 5½-yd. DRAGLINES 1¼-yd. — 6-yd. CRANES 25-ton — 100-ton

E&MJ NEW PRODUCT DIGEST



Electrochemical Method Detects and Measures Oxygen Content (1)

AIR CONTAINING less then 21% oxygen can cause unconsciousness; that containing less than 16%, death. The problem of oxygen deficiency has been well known in mines for centuries, and there are many old time devices available that help determine the oxygen level—small animals, the flame safety lamp, oxygen absorbing apparatus, combustion, magnetic character of oxygen, and direct electrochemical effect including the redox reaction.

These methods all present drawbacks and have not led to a practical solution of determining the oxygen level of the atmosphere. However, the latest development at Mine Safety Appliances Co. shows great promise.

This latest oxygen measuring instrument is based on an electrochemical method in which the oxygen of a test gas acts as a depolarizer at a porous carbon cathode in a simple galvanic cell.

The cell is not affected by carbon dioxide below 25% concentration due to the acid electrolyte used and the fact that the cell current is small. A simple uniform scale for all levels of oxygen concentration has been devised through proper current density and the size of the active carbon cathode surface.

Another significant improvement in the M-S-A instrument is decreasing the detector cell current by an opposing power source, a simple dry cell, rather than using a high resistance. Total current output of the cell is so adjusted in relation to the active carbon area that the current density per percent oxygen remains constant. Not only is the detector cell current decreased, but the cell is operated at a higher and more constant terminal voltage. These conditions lead to a faster cell response and a more nearly straight line calibration for oxygen content.

The M-S-A unit is a continuous analyzer and recorder with an accuracy of better than plus or minus 2% of full scale range (0 to 25%, 0 to 10%, 0 to 5% and 0 to 1% O_2) and needs very little service or maintenance. The unit is portable as shown above. The electroyte of the original laboratory model was a paste or jelly, but a liquid (which has a faster response) has been incorporated into the portable unit.

The ¼-in. dia electrode of the portable instrument is a carbon tube (1/8 in. I.D.) closed at the bottom, and is 2-1/8 in. long. Tubes are carefully processed, individually tested to extremely close mechanical and electrical tolerances, and tagged with two characteristics that enable instrument adjustment assuring indications within plus or minus 0.5% oxygen on the instrument scale. Insertion and removal of electrodes is as easy as replacing of a radio tube.

A cup-like rubber boot prevents electrolyte from reaching the metal parts of the electrode holder and prevents any gas from reaching the electrolyte except by way of the pores of the carbon and the interface of the carbon and electrolyte. A mixture of gases emerges near the closed bottom of the carbon tube and returns between the outside wall of the metal tube and inside wall of the carbon electrode. Oxygen in the small part of the sample that goes through the pores of the carbon to the interface with the electrolyte, reacts with hydrogen ions to produce a measurable electromotive force.

In the portable instrument a single dry cell serves the functions of three cells in the continuous oxygen analyzer. It provides bucking current, a source for zero adjustment, and a source for improvement of drift and temperature effects. Its useful life is almost equal to its shelf life.

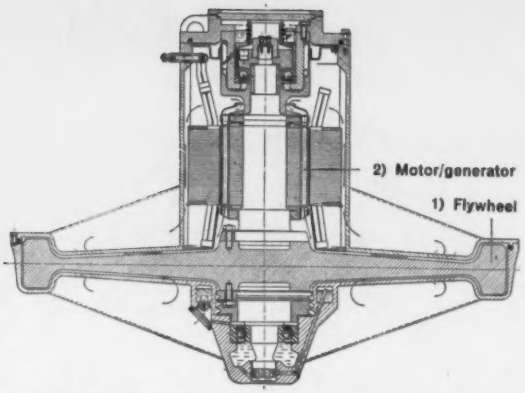
A novel "check arrangement" enables use of the oxygen indicating meter as a voltmeter to measure and adjust the voltage for the particular carbon electrode in use. The only other adjustment needed preceding a series of tests is setting the current output with atmospheric air as a sample to the 20.8% mark on the scale.

The accuracy of the portable oxygen indicator is plus or minus ½% oxygen. To maintain this accuracy the instrument should be reset on fresh air every 20 minutes, since the drift approximates 0.6% oxygen per hour. The carbon electrode and electrolyte must be replaced three to five times annually whether used regularly or not. Accurate measurements of less than 12% oxygen require a weekly zero check with an oxygen-free sample. Strong acid gases should be removed from samples. An accessory scrubber is available for this purpose. When carbon dioxide exceeds 25% the instrument should be flushed with fresh air at 10-minute intervals. The resolution is 0.2% oxygen on the higher half and 0.1% on the lower half of the square root scale.

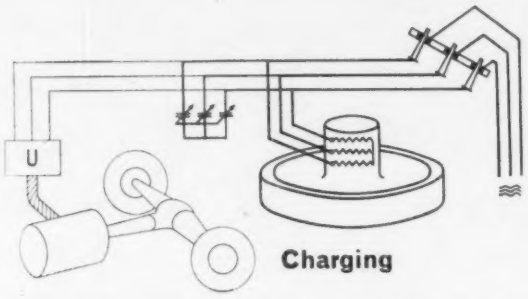
Temperature effect has been reduced to 0.5-0.6% per degree C, owing to use of the square root scale and proper circuit characteristics. Since the cell is surrounded by a Lucite jacket, which has a substantial thermal capacity and an insulating air space between jacket and cell, transmittal of temperature differentials is delayed for several hours.

Although the electrolyte used in these cells freezes at 26 to 27 deg F, the instrument has been operated for four hours at 18 to 20 deg F without freezing. The available power at full scale is only 3.75×10^{-5} watts.

THE ELECTROGYRO mine locomotive.



THE MOTOR-GENERATOR is mounted on the flywheel.



ELECTRIC energy is stored in the flywheel as kinetic.

Electrogyro Mining Locomotive Needs No Batteries or Trolley Wires (2)

AN ELECTROGYRO mine locomotive is being manufactured by Oerlikon Engineering Co., Zürich, Switzerland. Electric power for the traction motor on the locomotive is stored as kinetic energy in a flywheel-generator, and the same generator serves as an induction motor to charge the flywheel at the charging station.

A 100-hp Gyrotractor weighs 8½ tons (tractive effect is 3,500 lb) and is available in track gages from 24 to 37 in. The motor stores 3.5 kwh when starting with a flywheel speed of 3,000 rpm. Unit has a width of 53 in. and an overall length of 11 ft 8 in.

Oerlikon's first unit, a wheeled unit called the Gyrobus, went into regular service September 1953 at Yverdon, Switzerland. Others were installed from time to time in Belgium and in the Congo. Recently, Oerlikon has applied the principle to rail vehicles with about a dozen narrow-gage units in service in steel mills and mines in Switzerland, France, Belgium and South Africa; and a special 34-ton locomotive equipped with two Electrogyros is being used on the colliery sidings of the British National Coal Board in London.

The high-tensile strength flywheel has a 5 ft 4 in. dia, weighs 3,300 lb and can accumulate 24-million ft lb of energy at 3,000 rpm (approximately 9 kwh). A three-phase squirrel cage motor built onto the flywheel shaft spins the flywheel. The flywheel and motor form a unit which runs on ball bearings in a hydrogen-filled casing spring suspended in the center of the locomotive. The hydrogen in the casing, at less than atmospheric pressure (11 psi), reduces friction losses and cools the unit.

At the terminal, or at intermediate stations, the motor is connected to a power source over contact arms. A special arrangement of choke coils and capacitators limits the maximum current to 350 amp and the load to 250 to 300 kw. Recharging time varies between 30 and 120 seconds, depending on the distance travelled between chargings.

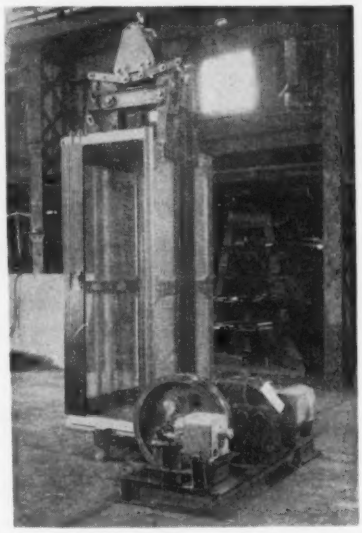
As soon as charging is completed, the contact arms are withdrawn and the induction motor is self-excited by switching in a series of capacitators. The motor now operates as a generator, converting the kinetic energy of the flywheel to electricity, driving the traction motor. The traction motor is a triple squirrel cage of special design with an output of 100 hp. The motor has six operating speeds with a top speed of 37 mph in the wheeled Gyrobus. At the maximum flywheel speeds, a Gyrobus can travel 5 miles on level ground without recharging. The Gyrobus can also negotiate 15 to 20% grades. As the flywheel runs down, so does the traction motor.

When the locomotive is stopped, the flywheel runs free in idle with very little loss of energy. Tests show that a fully charged flywheel running free will spin for 13 hours before coming to a stop. The locomotive can be braked electrically.

Small Cage Designed for Auxiliary Services Stresses Safety (3)

Connellsville Mfg. & Mine Supply Co.'s new Minicage is designed to transport men and materials in mines, mills, smelters, refineries and headframes where elevator installations might prove too expensive. The standard unit shown here is 6 ft 8 in. high, 3 ft in width and 4 ft in depth. Capacity is 1,000 lb and up.

The speed of the unit is slow, 50 to 75 fpm, to cut down the cost of the electrical control equipment. The compact, portable hoist consists of a multi-rope, friction-drive drum powered with an ac motor drive equipped with fail-safe controls. Operation is semi-automatic. No hoistman is needed. Designers say that the unit can be installed in strategic places underground to transport shift-bosses, superintendents, samplers, engineers and miners who now have to do a lot of strenuous climbing to reach or inspect working places. The installation can be moved readily.



New Model Trucks (14)

Ford Motor Co.'s 1959 line of trucks will include 371 models, including a tilt cab unit and a four-wheel drive model. The four-wheel drive model will be available in the F-100 and F-250 series, and equipped with an optional 292 hp V-8, the F-250 will climb grades of more than 60%.

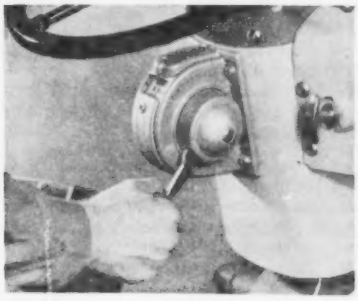
More than 150 models will be available in the heavy and extra-heavy line. There are six V-8's available with up to 534 cubic inch displacement.

Motor Grader (15)

No. 14 Motor Grader, rated at 150 hp and weighing more than 29,000 lb, has joined the line of Caterpillar Tractor Co. Engine is fitted with turbocharger. Transmission has 6 forward and two reverse speeds.

Diesel Engine (16)

Cummins Engine Co., Inc. is introducing two new engines—a 70 hp J-70 and an 80 hp J-80. Engines are designed for equipment that in the past has relied upon the gasoline engine for most of its power—light trucks, tractors, pumps, boats, graders, compressors and generators. Field tests show that these engines can cut fuel costs over gasoline models by 65 to 70c per operating hour. Engines are four cylinder, four cycle.

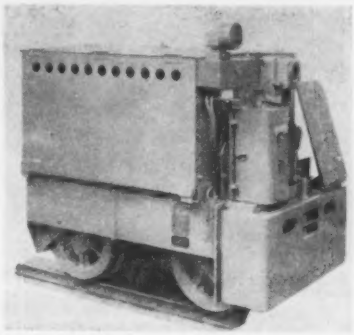


Tractor Loader (17)

A ten-speed fully selective power shift unit, called the Selecto-O-Speed, is one of the features of Ford Motor Co.'s 1959 line of tractors and tractor-loaders. System permits gear ratio changes while the tractor is in motion through 10 forward and two reverse speeds. Three models of Ford backhoes have been added to the tractor and tractor-loader line with four bucket sizes available—2.5, 4.5, 6 and 7 cubic ft.

Bowl Scraper (18)

No. 435 Series C. Lowbowl scraper with a struck capacity of 13 cubic yd and heaped capacity of 18 is now available from Caterpillar Tractor Co. for use with a D7 tractor.

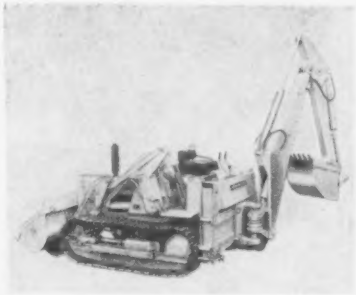


Battery Locomotive (19)

A 3½-ton storage battery locomotive designed with a telescoping cab that can be hoisted on a cage only 5½x4 ft is available from Atlas Car & Mfg. Co. Unit has rated drawbar pull of 950 lb at 3½ mph with a starting drawbar pull of about 2100 lb. Batteries can be either lead-acid or Edison type. Locomotive can be supplied in any track gage from 18 to 36 in.

Portable Compressor (20)

An addition to Worthington Corp.'s 600 cfm portable compressor line has been made—a rotary fitted with a Cummins engine and a over-under design that puts the first stage of compression directly over the second.

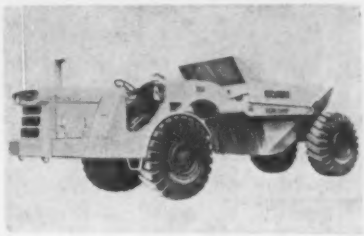


Tractor-Loader (21)

John Deere has two new diesel-powered tractors on the market—a 440 Crawler and a 440 Wheeled—both powered by GM 2-cycle Jimmy engines. The 440 series is available in gasoline engine as well as diesel.

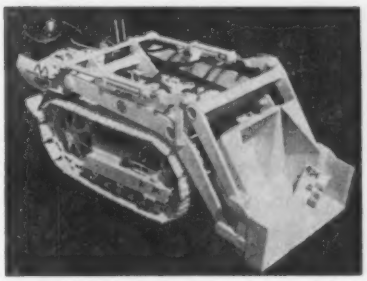
Crawler Tractor (22)

Production of a diesel crawler, the International TD-15 with 105 hp, has been announced by International Harvester Co. One feature of the machine is its six-speed, single-stick, full reverse transmission, designed with a shuttle bar control that permits instant reverse or forward without shifting.



Wheeled Rear Dump (23)

Michigan Model 110 Tractor Wagon designed by Clark Equipment Co. has 13 ton load capacity (12 yd heaped) and is low enough to be loaded by virtually any power shovel, conveyor or tractor shovel.

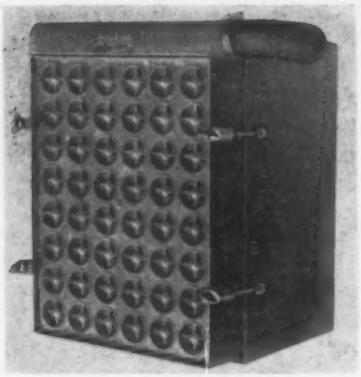


Crawler Loader (24)

Machinery Center, Inc. has come out with a front-end, air-powered loader and dozer for underground or surface use. Unit will perform under headings as low as 4 ft. Air motor is 15 hp, reversible, direct drive through a three-speed transmission. Four models in these bucket capacities are available—⅜, ⅜, ⅝ and 1 cubic yd.

Rear Dump Trucks (25)

Freeport Nickel Co. recently purchased 18 Oshkosk Model W-2800 rear dumpers to haul ore from Freeport's nickel operations in Cuba. Model W-2800 has pay load capacity of 30 tons, and features all-wheel drive and exhaust heated dump bed to permit cleaner dumping of the moist sticky ore. Engine is a 320 hp Cummins NHRS-6-B.



Dry-Tube Air Cleaner (29)

Farr Co. has introduced a dry-type engine air cleaner which offers hundreds of hours of high efficiency service. First stage of the unit centrifuges out large particles and the second stage, a fabric type paper element, gets the fines. Available for all standard power units.

Motor Grader (26)

Allis-Chalmers Mfg. Co. has offered a Model 145 motor grader with 80 hp and 21,450 lb weight which now gives A-C three graders from 58 to 120 hp. Model 145 has four cylinder diesel.

Allis-Chalmers also announced a new medium-size bowl scraper—the TS 260—with 12.5 cubic yd struck (17 cubic yd heaped) capacity. Unit is powered by a 230 hp six cylinder diesel engine.

Bowl Scraper (27)

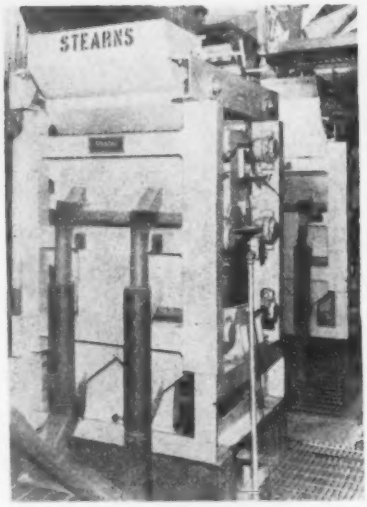
The struck capacity of the LeTourneau-Westinghouse BT Fullpak scraper has been increased from 18.7 to 21 cubic yd through some very minor changes in design, according to LeT-Wesco engineers. Unit is designed for tractors of 150 hp or larger.

Bowl Scraper (28)

Curtiss-Wright Corp. announces Model CW-226 bowl scraper with 26 cubic yd struck capacity (36 cubic yd heaped). Unit is powered by 375 hp GM 6-110T diesel through an Allison automatic transmission and torque converter. Tractor is interchangeable with the Curtiss-Wright 35-ton rear dumper.

Slurry Control Valve (33)

Valve, designated Model C by Clarkson Co., is designed for abrasive or corrosive slurries in cast steel with two-piece housing jackets of 1-in. gum rubber or Neoprene. Liner is low cost and easy to replace. Plant air or hydraulic controls are used to operate the valve. Sizes available are 1½, 2, 3, and 4-in. full diameter.

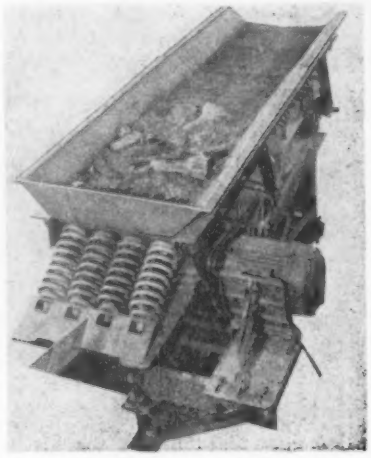


Magnetic Separator (34)

A high-intensity induced roll magnetic separator is offered by Stearns Magnetic Products that is remarkable for its ability to separate materials formerly considered unresponisve to magnetics. Material is fed to each roll in the unit by gravity.

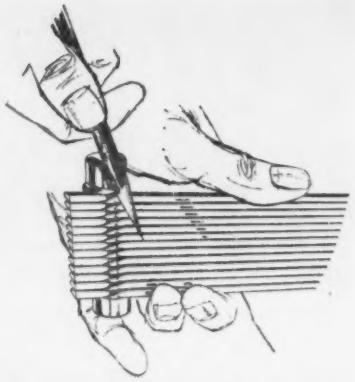
Enclosed Screen (35)

Equipped with air springs, the standard open type floor mounted screen is now available from Allis-Chalmers in a totally enclosed cover. An exhauster outlet can also be provided. Sizes available are 6x16 and 5x16 ft.



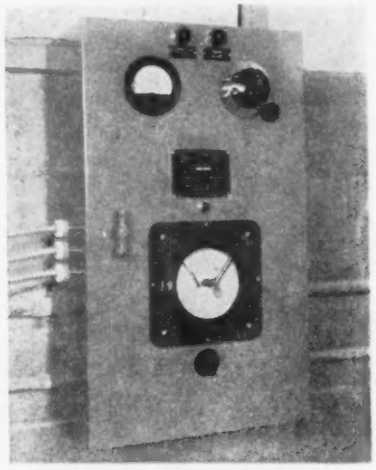
Vibrating Conveyor (36)

Carrier Conveyor Corp. has developed a mechanical conveyor that moves materials uphill at inclines of 5 to 25 deg. Deck consists of hundreds of small steps. The unit is driven by Carriers exclusive Natural-Frequency drive.



Taper-Slot Screens (37)

Wedge-Wire Corp. says that their Taper-Slot screen construction consists of a series of wedge-shaped wires looped at regular intervals around a cross rod positioned at right angles to the wires. Typical distance between loops is 2¾ in. In Taper-Slot design, opening between wires gradually increases between loops. Design is said to reduce screen blinding.



Grinding Mill Controls (38)

Hardinge Co., Inc. has four new Electric Ear control and observation units in production. Unit can increase grinding efficiency by 10 to 20%. It indicates operating and down time, bin condition, changes in control setting, and erratic mill operation due to change in the character of the feed.

Twin Jaw Crusher (39)

Cedarapids Challenger crushing and screening plant from Iowa Mfg. Co. is said to provide 40 to 100% greater primary crushing capacity than a plant with a single jaw unit. Highspeed 12x36 in. Twin Jaw unit has overhead eccentric design which moves the synchronized jaws at high speed inward and downward. Challenger plants can turn out up to 540 tons per hour of minus 1½-in. product.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Exploration and Mining

DRILL HOLE survey kit centered around the Maas compass and Exploration Methods Inc.'s Goniometer, and which contains enough material to survey 100 or more holes, is explained in literature from the company. **(60)**

HANDBOOK of Electric Blasting—a 60-page pocket edition—makes plain, for the novice as well as the experienced blaster, the whys and hows of effective electric detonation. Illustrated and published by Atlas Powder Co. **(61)**

BLASTING cost chart—a small field record about the size of a postcard available free from Atlas Powder Co. —provides a quick way to keep track of blasting cost and performance. Also available are the blast summary card and the hip pocket hole loading chart. Copies are available from the company on request. **(62)**

BLASTING AGENT booklet prepared by Hercules Powder Co. lists all Hercules explosives, blasting agents and supplies. Dynatex and Kanite are included. 82 pp. **(63)**

MINING TOOL catalog—M-9 from Kennametal Inc.—includes all the recent additions and modifications to the company line. 20pp. and price list. **(64)**

MINING LOCOMOTIVE brochure from Plymouth Locomotive Div., Fate-Root-Heath Co. includes the latest industrial and mine locomotives produced by the company. Sizes range from 3 to 80 ton in gasoline or diesel power. **(65)**

ALLOY CAST STEEL mine car wheels engineered by Farrell-Cheek Steel Co. are introduced in a four-page bulletin. **(66)**

CONTINUOUS BORER, the Goodman Mfg. Co. Type 300, is detailed in an 8-page catalog (G-124). Goodman also has a bulletin (G-141) on the general design and operation of the Goodman continuous borer. **(67)**

DOZER and scraper blades made from International Harvester Co. Durablade special heat-treated stock have a surface hardness of two to four times that of untreated blades according to booklet (CR-177-1). Booklet lists the types and sizes of Durablades available. **(68)**

TRANSIT CRANE—a 45-ton Model 30-B from Bucyrus-Erie Co.—is detailed in literature available. Unit can lift a maximum of 45 ton on a 40-ft boom. **(69)**

CAT "V" ENGINES for excavators is the title of an 8-page bulletin from Caterpillar Tractor Co. that lists some operations in detail where Cat "V's" are used to provide the power. **(70)**

ALL THE MODELS in General Motors Detroit Diesel Engine Division All-Purpose Power Line are discussed in a 12-page bulletin. Single, multiple and turbocharged diesels in 20 to 1650 hp are available. **(71)**

DATA SHEETS with cut-away illustrations of Model 45 motor grader (MS-1325), HD-16 (MS-1192) and the HD-16 DC and D diesel crawlers (MS-1284) are available from Allis-Chalmers Mfg. Co. **(72)**

CENTRIFUGAL BLOWERS having a wide range of pressures and volumes from 440 cfm at ¼-in. static pressure to more than 460,000 fm at 16-in. pressure are discussed in information from Joy Mfg. Co. on their Joy-Centrifoil fans. **(73)**

VERTICAL all-weather motors in ratings from 1 to 30 hp may be examined through literature from Louis Allis Co. (2500). **(74)**

RIGHT ANGLE gearmotors from Louis Allis Co. come in ratings from ⅛ to 30 hp according to a four-page bulletin (3050). **(75)**

SHORT CIRCUIT protection for trailing cables is described in a four-page bulletin published by Ohio Brass Co. on Type A Magna-Trip interrupters. (1422-M). **(76)**

PISTON AIR MOTORS in the Joy Mfg. Co. line in motor ratings from 11½ to 20 hp and having an output of from 19 to 800 rpm on the shaft are presented in literature from the company. **(77)**

MAN-MADE DIAMONDS are being used in diamond wheels for carbide grinding according to the latest Carborundum Co. bulletin. 4pp. (A-1504 5M 2-59). **(78)**

V-BELT DRIVES bulletin prepared by Dodge Mfg. Co. details the new Dyna V line of V-belts that are smaller, lower cost and lighter than conventional belts. 44pp. **(80)**

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16 mm movie film from which this enlargement was made.

This unretouched photograph was enlarged from a 16 mm frame. It shows a multiple hole blast detonated with Primacord, and hooked up with Primacord MS Connectors in the trunk line. Note the steady progress of this blast from the point of initiation at the left, as indicated by the red line.

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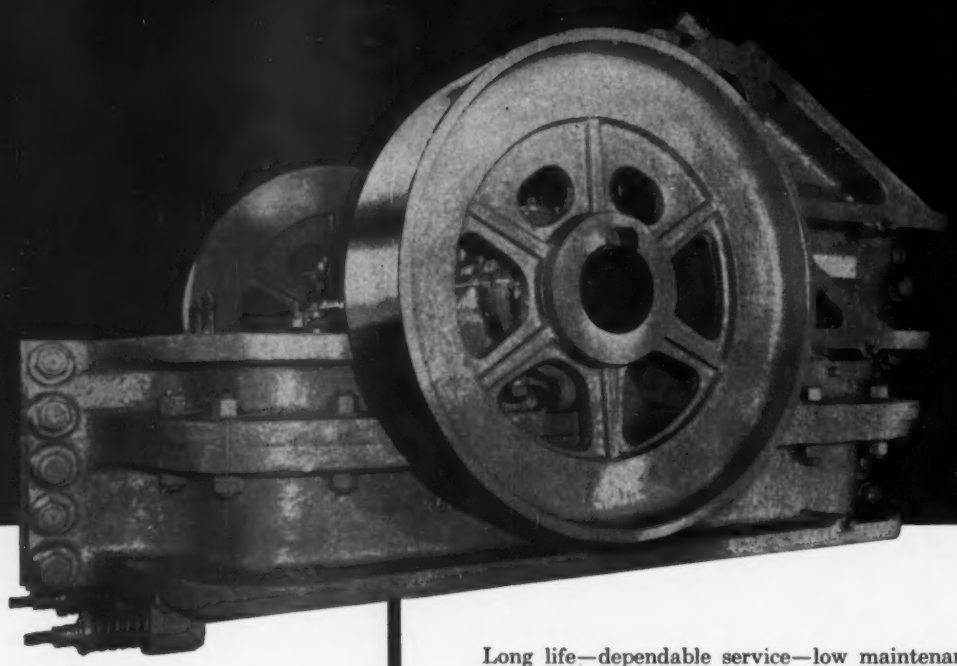

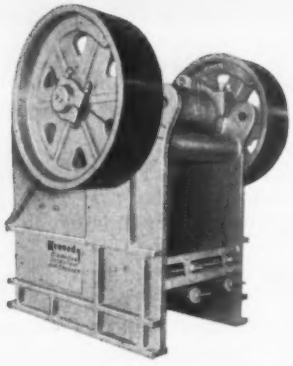

The KENNEDY Overhead Eccentric Jaw Crusher features a massive, one-piece, arc welded steel plate frame, and is available in standard sizes from 10″ x 36″ to 36″ x 42″.

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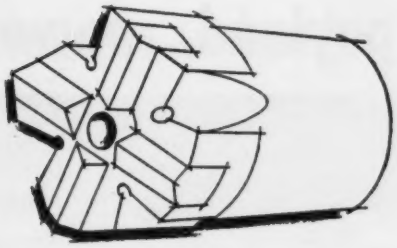

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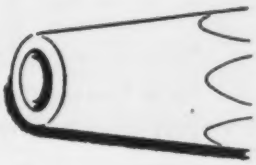

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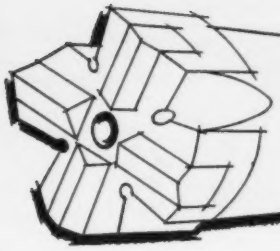


ONE-PIECE STRENGTH

IN AN AIR-LEG BIT!

AIR-LEG drillers, now you can have your cake and eat it, too. The new Timken® tapered socket carbide insert bit is removable—yet gives you the strength of one-piece steels. The secret is the taper. It gives you all the advantages of removability with a strong, secure union.

Here are a few of the plusses you get with the Timken tapered socket but can't get with intraset steels because they're not removable.

1. You don't have to throw away the drill steel just because the carbides wear out. You do with an intraset steel.

2. You carry just a pocketfull of bits into the mine. Try putting an intraset steel in your pocket.

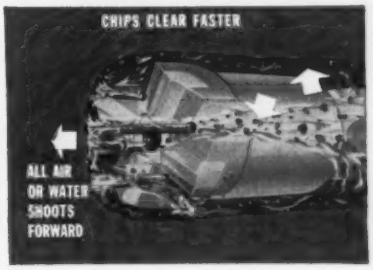
3. You can quickly change bit gauge sizes using the same steel. With an intraset steel, you have to change a whole steel.

4. You don't have to lug the whole steel back to the shop to resharpen the cutting edges. You do with a 4-point intraset steel.

5. You get four carbide cutting edges. You get only two with a chisel intraset steel.

And you get further economies because the Timken Tapered Bit clears chips faster. The picture at right shows you how. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance. And they can be reconditioned many times.

For removability *and* strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



CHIPS CLEAR FASTER because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster.

See us at the AMERICAN MINING CONGRESS 1959 COAL SHOW, Cleveland Public Auditorium, Booth 900, Cleveland, Ohio. May 11-14, 1959

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

AVAILABLE NOW!

THE AIR-LEG BIT OF THE FUTURE

Heavy Construction Operators

GO FORD-WARD for greater payload... power..

"Our Ford trucks haul up to a ton-and-a-half more payload per trip"

says William R. Collins, V.P.
William Collins and Sons, Fargo, N.D.

"We switched to Ford trucks in 1951 because we found we could haul 1½ tons more per trip. Now we have 124 Fords, including 80 T-700's. They're economical to operate, too—we get up to 6 miles per gallon. Our drivers like Ford's power steering and peppy 302 HD V-8 engine. We like Fords because we know we can always get Ford parts quickly if we need them. That means our trucks aren't down over one day, even on a major overhaul."

"We trade every two years and find that Ford trucks bring highest resale price"

says John McCormick, Sec.-Treas.
Northern Improvement Co., Fargo, N.D.

"We keep our Ford T-700's in top condition year round, and it pays off. We get a higher resale price when we trade every two years. Fords have the ability to perform under the rugged conditions in our work. Power steering on our tandem dumps makes them easy to handle on-or off-the road.

"Our drivers like Ford's power . . . they get heavy loads under way fast"

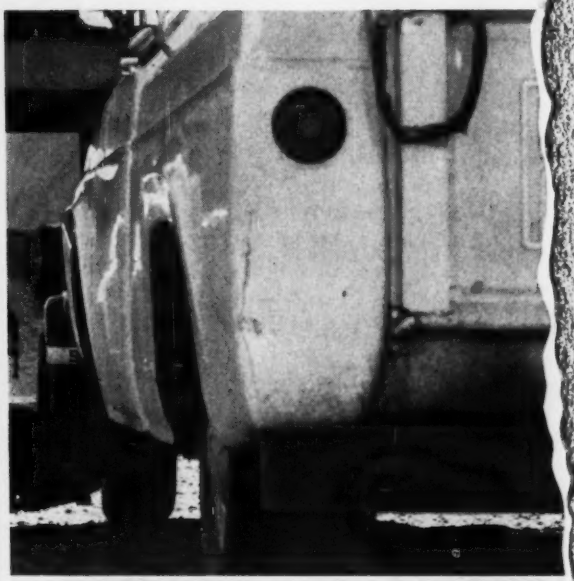
says George C. Wilson, General Superintendent
Schultz and Lindsay Construction Co., Fargo, N. D.

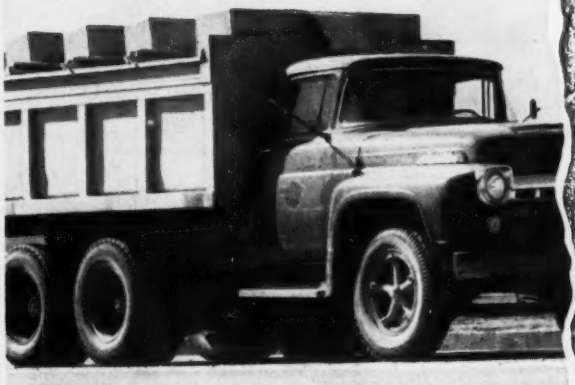
"Ford's HD power in our T-750's gets heavy loads under way fast . . . helps keep us on schedule. And we can haul bigger payloads doing it . . . up to a yard more, legally, every trip. We've never had frame trouble either. They're rugged, durable trucks and if we ever need Ford parts, we can always get them at the nearest town."

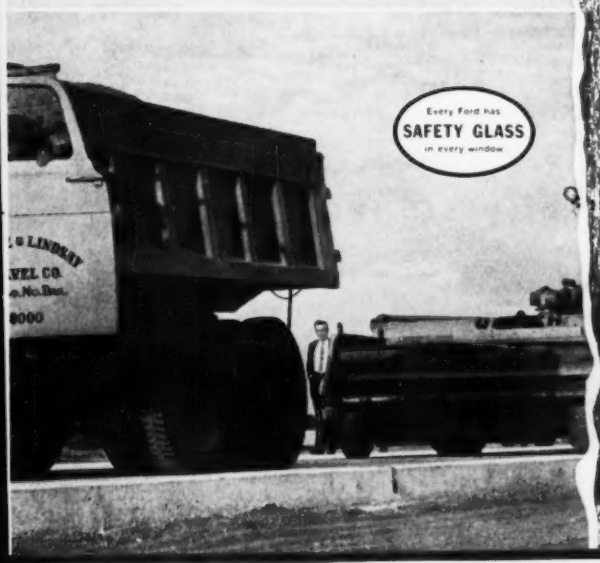
FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN... LAST LONGER, TOO!

..resale value!







NOW!
CERTIFIED PROOF
FORD TRUCKS
COST LESS

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
*NAME AVAILABLE ON REQUEST
Send inquiry to: P.O. Box 2687 Ford Division, Ford Motor Co. Detroit 31, Michigan

'59 Ford Pickups Win Economy Showdown U.S.A.

—average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's ½-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested — by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

The '59 Ford Sixes, *in every test*, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

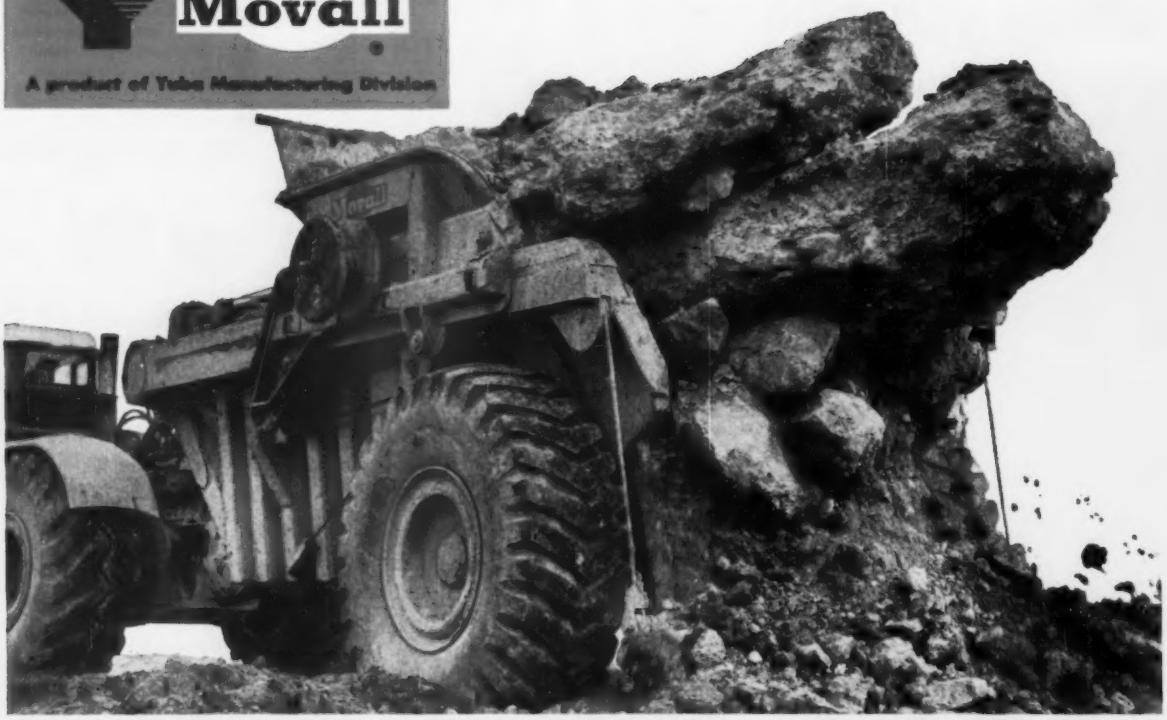
Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both low- and high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's *Economy Carburetor* is *standard at no extra cost.*

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

YUBA

Movall

A product of Yuba Manufacturing Division



EVERYTHING GOES!

EXCLUSIVE LEVEL-ACTION EJECTOR SAVES TIME AND MONEY

LOADED—The big target, big capacity body carries its load low, maintaining high ground clearance since frame and body are integral and compact.

TAIL GATE UP

DUMPING—Level body offers no gravity resistance, with potential 140,000 lb. ejector push assuring complete positive discharge with minimum use of power.

TAIL GATE DOWN

EMPTY—Sides and bottom are scraped clean, eliminating need for "mucking out" or decreasing capacity for next full load. Complete ejection takes only 11 to 14 seconds.

TAIL GATE DOWN

140,000 pound push cleans out desk-size rocks or sticky clay—clean as a whistle in just 14 seconds!

The versatile, high-speed Yuba "Movall" outperforms rear and bottom-dump haulers on most every type of off-highway job! Its powerful, positive ejector makes playthings of giant rock, frozen muck, or any other top loaded material. Bigger year 'round profits are yours with low-maintenance "Movalls" on the job. Check their unbeatable combination of features, such as high clearance, 180° turning radius, full stability in *all* operations, big tire flotation and traction, huge capacity. Get full information from your Allis-Chalmers, Caterpillar, or International Harvester Dealer, or contact *Yuba Manufacturing Division, Benicia, California,* today.

YUBA CONSOLIDATED INDUSTRIES, INC.

Plants and Sales Offices

YUBA

Yuba designs and builds a wide range of equipment for the mining industry, including:

SHOVELS—BUCKET LADDER & HYDRAULIC

DRAGLINE—SIDE CASTING

DRILLS

CUSTOM ORE-HANDLING EQUIPMENT

Shrink distance...and OVERHEAD

with hustling, go-anywhere tractor

Are you still supporting *part*-time pit workers — 3 or 4 crawler tractors — for maintenance jobs? You're carrying unnecessary overhead if you do. Limited speed and mobility tie crawlers down to a limited working area. Lack of continuous work in those "pockets" often keeps them idle much of the day. Yet the cost of owning and maintaining a fleet of localized dozers is continuous.

It's possible that you may be able to replace those inefficient units with a single tractor... a mobile dozer-*on-rubber* that goes anywhere anytime you have work to be done. The 17-mph, 218-hp LeTourneau-Westinghouse C Tournatractor® is a "hit-and-run" specialist that handles pit housekeeping *just* as efficiently as a fleet of several special-purpose crawlers and can often cut clean-up and other dozing expense by half the present cost or more.

Travels at twice crawler rate

Tournatractor gives you the speed and mobility that pays off in servicing scattered locations. Travel to the next job is at speeds up to 17 mph — twice as fast as that of most crawler-mounted dozers.

Speed ranges, 4 forward, 2 reverse, are selected by simple hand lever. Within ranges, torque converter automatically adjusts power to load. Blade movement is accurately controlled electrically, through fingertip dashboard switches.

Check your multiple tractor operations for productive hours of operation. If travel and waiting time figures 30% or more be sure to ask for a Tournatractor demonstration.

Stripping dirt and clay overburden is just one of many jobs C Tournatractor takes in stride for Millbrook Quarries, Inc., Broad Run, Va. Handy "hit-and-run" dozer also cleans up pit after blasting, shapes limestone stockpiles, cleans around crusher, and tows equipment. Output averages 1,000 tons per day.

"If I could get a hold on it, I could move a mountain with this Tournatractor," says Operator Claude Wampler at Millbrook Quarries. "This dozer's got plenty of power and speed, doesn't take all day to get to a job. It's easy to throttle down from high travel-speed."

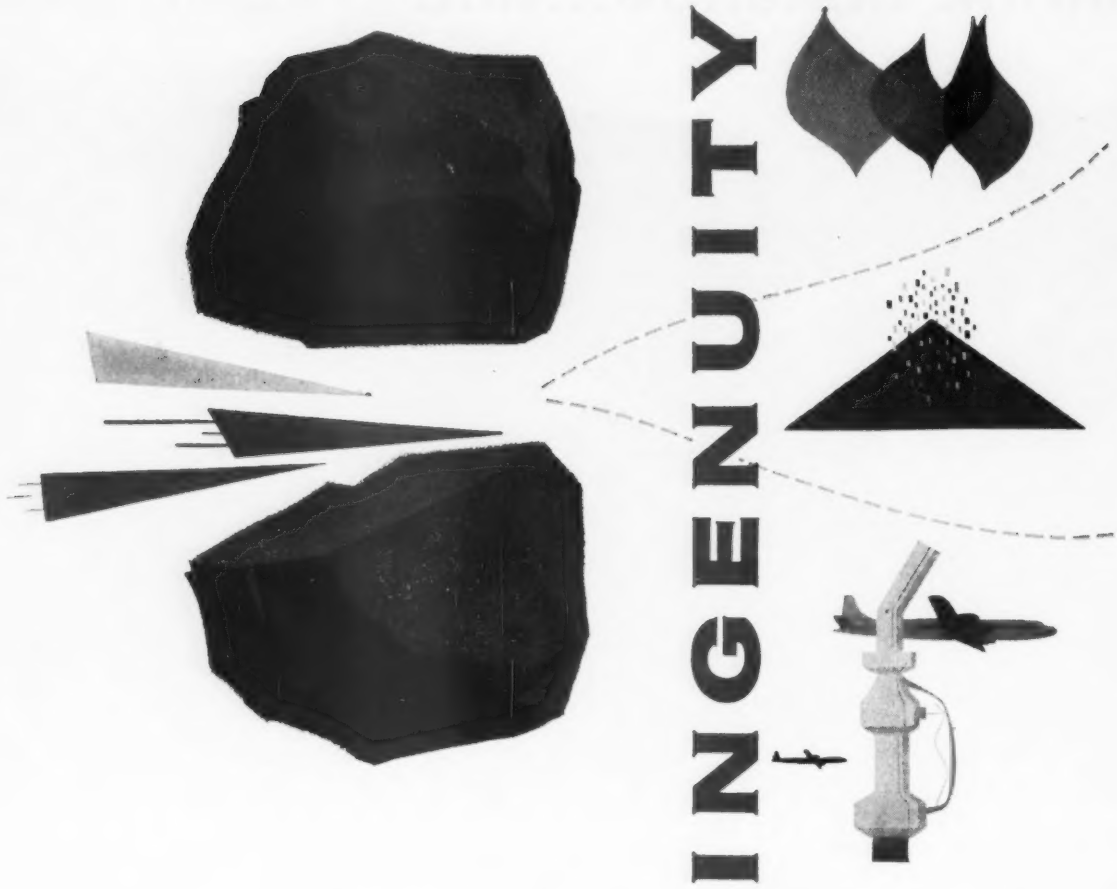
CT-2027-MQJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

call KE for plant expansion or new facilities



has made KE a major engineer-contractor serving Minerals and Petroleum

Nation's pioneer major commercial Gilsonite refinery near Grand Junction, Colorado... Another example of KE ingenuity.

Ingenuity at work—at American Gilsonite, Kaiser Engineers designed and built an enclosed, controlled-atmosphere calciner with associated power and plant equipment making possible 100% utilization of raw Gilsonite. First major all-commercial Gilsonite refinery built, the new plant produces 99.50% pure coke, extreme purity gasoline, and uses gaseous residue to power the entire facility.

From economic analysis through start-up, KE builds ferrous, non-ferrous, industrial minerals and petroleum processing plants; brings valued experience to every phase from mining and beneficiation to transportation and materials handling.

Let KE ingenuity save time and money for you. With your first thought of new facilities or expansion, call KE.

KAISER ENGINEERS engineers—contractors
Contracting since 1914

4385

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

Maneuvering into or out of narrow, twisting underground tunnels is easy for LeTourneau-Westinghouse Rear-Dumps. Model D can U-turn in less than 25'. If roof clearance is 14'8" or more, "D" can raise bowl and turn in a tight 18'8" of clearance.

Fast, clean dump by 11-yd D Tournapull Rear-Dump speeds rock to crusher at Fort Hartford Stone Co., near Hartford, Ky. Electric motors, standard on all Tournapull units, raise and lower bowl with speed and safety.

"Only units maneuverable enough to give us good production"

That's how Mr. A. C. Hall, owner of Fort Hartford Stone Co., Hartford, Kentucky, describes the 4 LeTourneau-Westinghouse D Tournapull® Rear-Dumps that move up to 225,000 tons of limestone a year from deep inside the firm's underground mine.

Three of the 11-ton-capacity L-W units are usually assigned to haul excavated rock from shovels working in the tunnels. They complete 6,000′ round trips . . . one third of that distance inside the narrow tunnels . . . in an average of 12 minutes. Of this operation, Hall says: "Large trucks just can't turn in the working area. 'D's' are the only machines that can maneuver in the tight quarters of the working faces without stopping. It cuts lost time."

Double-duty yard workers

Another "D" normally works in the open, stockpiling rock and gravel, and pushing rail-cars. At times, the whole L-W Rear-Dump force teams up with 2 front-end loaders to fill rail-cars in the yard. Rear-Dumps carry the material from crusher to stockpiles near the cars. Tractors then load it aboard. This "teamwork" loads a car in an average of only 12 minutes elapsed time.

Six years of tire use

"D" maintenance is easy. Hall cites tire-life as an example. "Our first Rear-Dump was new when we bought it," he said, "and it was six years before we had to replace a tire.

"Whenever I've decided to buy another hauler, I've considered all makes carefully. And I've always decided on a Tournapull Rear-Dump."

LeTourneau-Westinghouse Rear-Dumps are available in three sizes: the 138-hp, 11-ton "D"; 226-hp, 22-ton "C"; and 335-hp, 35-ton "B". Ask for a demonstration of the model best suited to your work.

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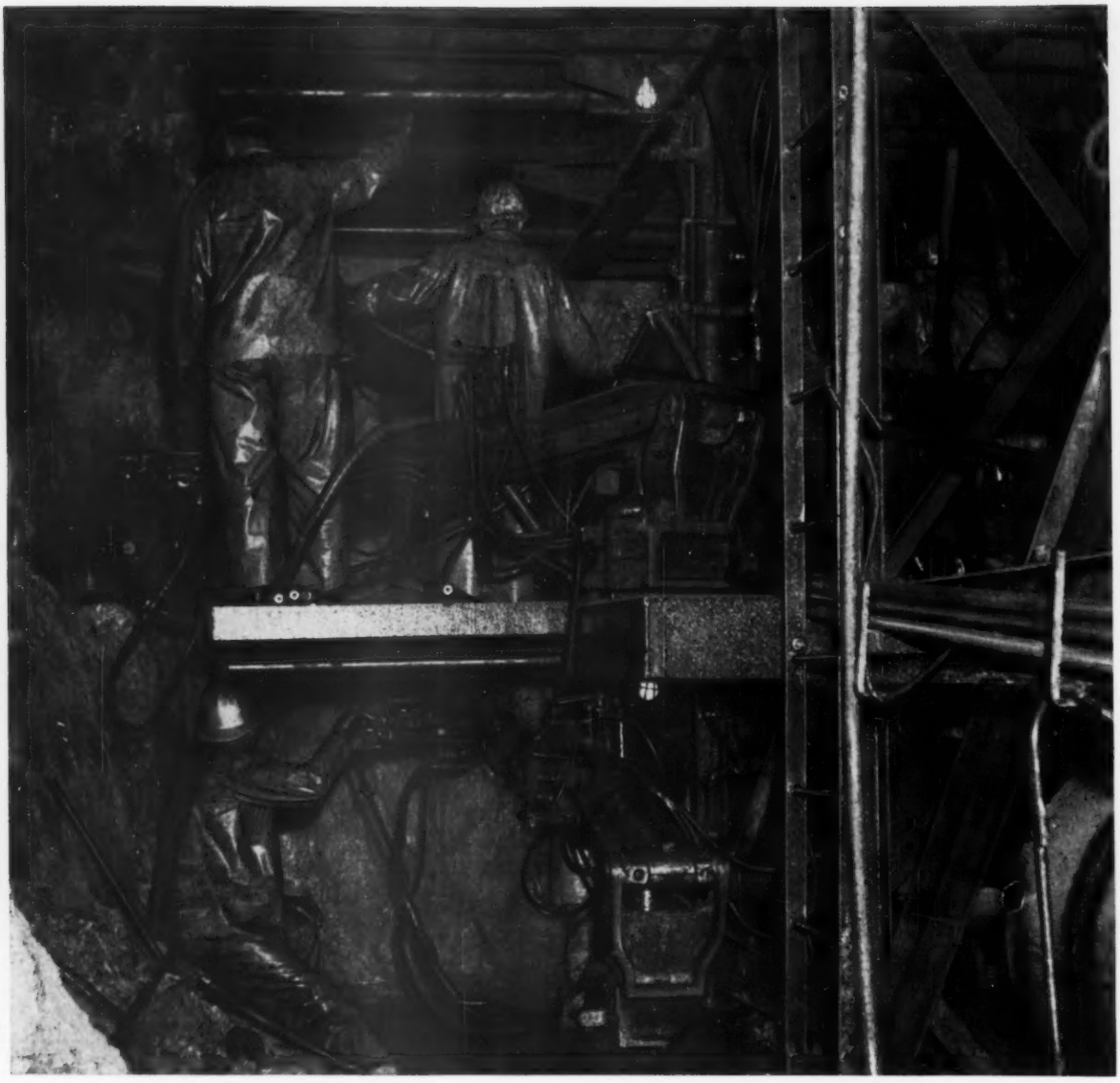
LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



Steel Bites Granite at Fremont Canyon

Using Bethlehem Hollow Drill Steel to bore most of the blast holes, the contractors are making steady progress in removing 225,000 cu yd of rock, most of it granite. The scene: Fremont Canyon Power Plant and Power Conduit Project in Wyoming.

Authorized by the Missouri River Basin-Glendo Dam Unit of the U. S. Bureau of Reclamation, the project is about 40 miles southwest of Casper. Besides driving two 3-mile tunnels the contractor is excavating for the power house. Said W. W. Roberts, superintendent for the Coker-Kiewit-Cunningham combine: "Bethlehem Hollow is providing good service on this job. We like it."

You can count on good service in any type of rock with Bethlehem Hollow. Rolled from a special fatigue-resistant steel, it has a uniformly round hole. Easy to heat-treat, it has a wide quenching range.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades, in all standard sections and lengths. Make sure you have Bethlehem Hollow on your next rock removal job.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

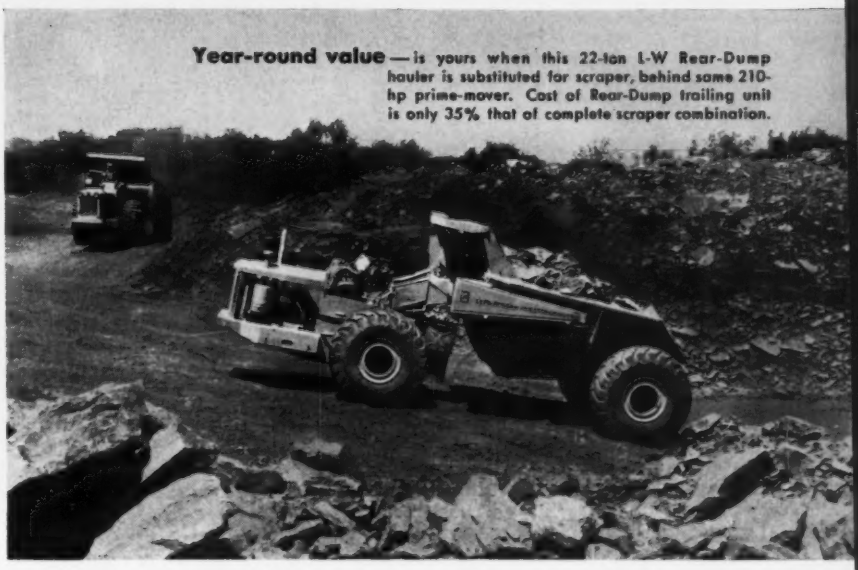
BETHLEHEM HOLLOW DRILL STEEL

BETHLEHEM STEEL

Efficient stripping — is certain with this easy-loading 20-ton (18-yd) scraper. Large bowl capacity, and machine's easy maneuverability, speed removal of overburden. Use scraper, too, to repair old haul roads and build new ones, clean up odds-and-ends of earthmoving on your property.

For shallow stripping, this scraper's your best bet

gives you year-round service with interchangeable L-W Rear-Dump



Year-round value — is yours when this 22-ton L-W Rear-Dump hauler is substituted for scraper, behind same 210-hp prime-mover. Cost of Rear-Dump trailing unit is only 35% that of complete scraper combination.

Time means money when you're stripping varying depths of overburden in your pit. If overburden is free of rock, and is shallow and wide-spread, crawler-type excavators — such as shovels, draglines and crawler dozers — move slowly to new work areas, increase your costs. Furthermore, they can only dig and cast ... require other machines to haul spoil to out-of-the-way disposal areas.

Self-propelled scrapers move shallow, non-rocky overburden at lowest cost per ton. Since stripping is a periodic job, most scrapers are sidelined many days during the year because there is not enough steady work. Not so with LeTourneau-Westinghouse C Tournapull®. When you finish stripping, you simply interchange its 18-yd scraper for a 22-ton Rear-Dump trailing unit. Thus your 210-hp L-W prime-mover works productively for you all the year-round for greater profit.

Cost of the interchangeable hauler trail unit is only 35% of that of prime-mover and scraper combinations. Other interchangeable L-W work units include Bottom-Dump, Side-Dump, and Flatbed haulers.

Tournapull "extras" speed operations

All off-road L-W Tournapull units have easy maneuverability for work in restricted quarters, instant electric control of all work functions. They have powerful brakes (largest in the earthmover field), dependable power-steer, and exclusive, power-transfer differential which keeps these machines working in soft going when other haulers bog down.

All-around usefulness, and interchangeability of hauled units make L-W 'Pull† a sound investment for your pit. Ask for complete specifications, and a demonstration.

†Trademark CPCR-1867-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

JOB RECORDS PROVE

Firestones deliver more hours of service!

Firestone Off-The-Highway Tires are cutting hourly costs on the roughest jobs in the business! That's because every Firestone Tire is built with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires! Tough Firestone treads and sidewalls defy cuts in rubble and shale. Exclusive Firestone S/F (Shock-Fortified) nylon bodies resist damage from bruising shock and impacts. And job-engineered tread designs always give the traction you need under any operating condition. Call your Firestone Dealer or Store and ask him about Firestone's full line of tubeless and tubed off-the-highway tires and on-the-job tire service.

Rock Grip Excavator* Wide Base

Rock Grip Excavator*

*Firestone T.M.

When ordering new equipment always specify Firestone tires—available tubeless or tubed

Firestone

BETTER RUBBER FROM START TO FINISH

Enjoy the Voice of Firestone on ABC television every Monday evening.

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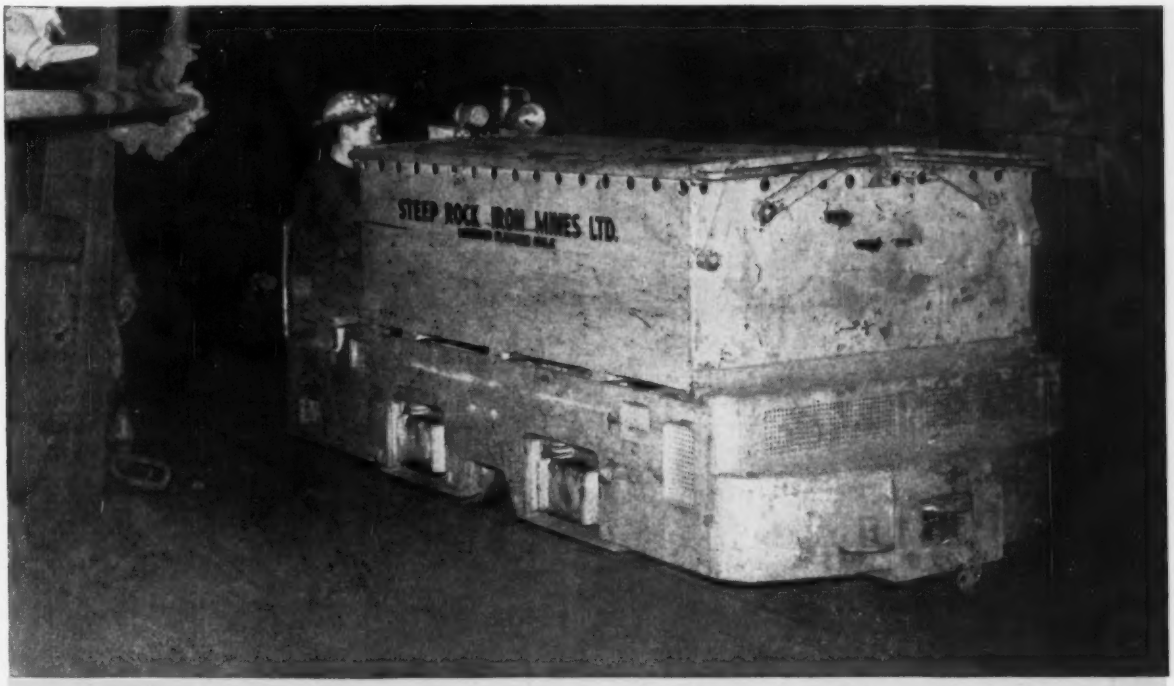


Development haulage problem solved with MANCHA storage battery locomotives

***customized* for Steep Rock Iron Mines, Ltd., Ontario**

When Steep Rock's Underground Mining Department analyzed standard face loading cycles in development headings, it was decided that efficiency could be considerably increased by using a larger capacity car than normal.

After careful study, a 13 ton capacity drop-bottom car design was selected. Four cars would carry a full round, appreciably reducing car change time at the face . . . a major cause of delay in normal loading operations.

Snapping these large, heavy cars in and out behind the loader would obviously be extremely hard on the locomotive so Mancha custom designed a special heavy duty model capable of withstanding such use. All the special features called for by the Steep Rock Safety Department were carefully incorporated . . . insuring complete protection for the motorman, maximum operating efficiency and low maintenance.

Result—the Mancha Standard ABX with the right specifications and special features for the job—

Operating weight—7 tons
Motor—21 hp
Running speeds—3-6 mph
Direct connected axles to prevent wheel spinning
Protective shield for motorman's cab
Hood over controller
Manually operated quick-acting hydraulic brake
Dead man foot switch protection
Provision in motorman's cab for radio
Heavy duty camtactor controller
Oversize axles, gears and journal bearings

Mancha specializes in underground haulage locomotives and welcomes the opportunity to discuss your problems and requirements. May we have a representative call?

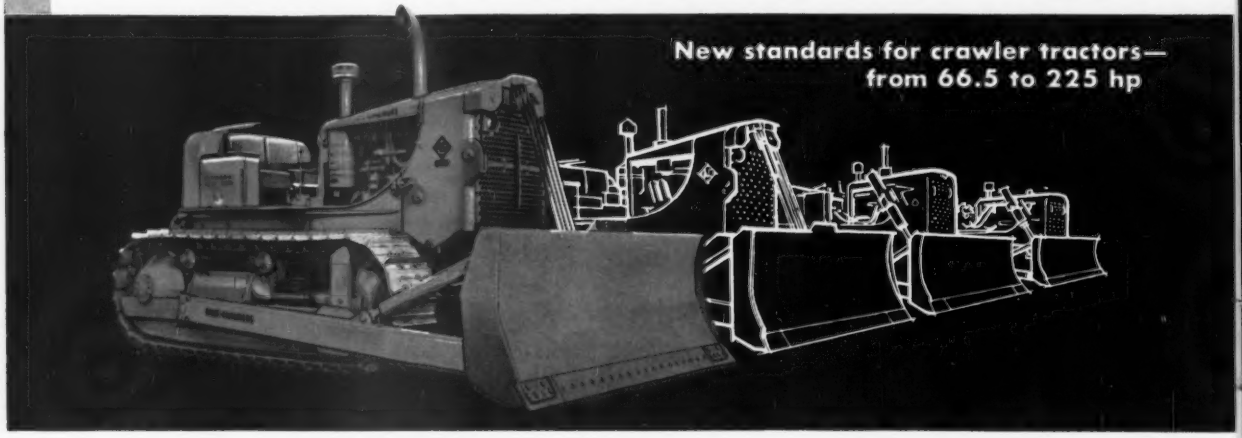
MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY
Halsted Street and 48th Place • Chicago 9, Illinois •
Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.

How to get more tractor for your dollar

Advantage	What it means to you
All-steel main frames	Power train protection Better equipment mounting Better weight distribution
Permanent lubrication of truck wheels, idlers and support rollers	No more wasted time greasing these track components
Torque converter drive	Matches power to load automatically Transmits power smoothly Less shifting
Double reduction final drives	More clearance Longer gear life
True unit construction	Faster service Easier access to all major assemblies



move ahead with ALLIS-CHALMERS.

In the chart below are five important crawler tractor advantages. These features have earned recognition by all makers of crawler tractors—one or more are now included in their latest designs. It stands to reason that the more of them you get on your next crawler, the more it is worth to you.

Where you get it
Allis-Chalmers is the only manufacturer offering main frames in *all* models. Two other manufacturers now offer them in one model.
Allis-Chalmers is the only manufacturer offering permanent lubrication of truck wheels, idlers and support rollers on *all* models. One other manufacturer offers permanent lubrication on three models.
Allis-Chalmers pioneered it in crawler tractors in 1940 . . . offers it in two tractor shovel models, two tractor models. All other major manufacturers now offer it as optional equipment in one or more models.
Allis-Chalmers is the only manufacturer offering double reduction final drives on *all* models. One other manufacturer offers it on three models.
Allis-Chalmers is the only manufacturer offering true unit construction in *all* its models. Two other manufacturers now offer modified unit construction in part of their lines.

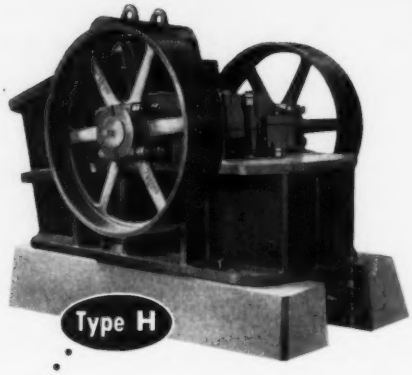
Here's proof that other manufacturers of crawler tractors have chosen to "follow the leader" with Allis-Chalmers engineering . . . and that your Allis-Chalmers dealer is the man to see for top value in crawler tractors. He'll be glad to demonstrate the model of your choice. It will have more industry-approved advantages than any other unit near its size. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

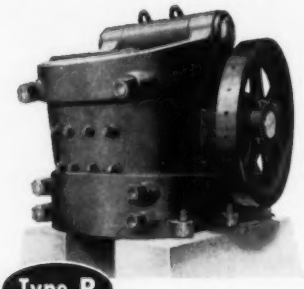
. . power for a growing world

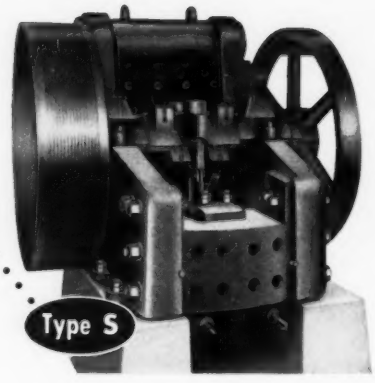
Many operators throughout the world know the economy and rugged dependability of Traylor-Made Jaw Crushers. Over 50 years of experience results in many advantages for the user of these crushers.

Traylor-made Jaw Crushers

Some of the features incorporated in Traylor Jaw Crushers are jaw plates of the Traylor curved type—the pitman shaft is made of annealed open hearth forged steel. The swing jaw is made of cast steel of extra heavy design for maximum strength. For more of the features of Traylor Jaw Crushers, write to Traylor today.







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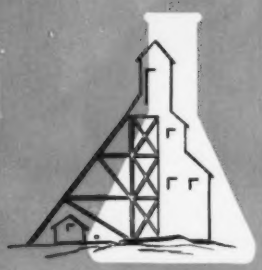
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.



CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

for metallurgists and mill men

Mineral Dressing Notes No. 24

COLOR MICROSCOPY FOR THE MILL MAN

Color microscopy can be an invaluable preliminary to reagent test work by revealing the degree of locking, dissemination, oxidation, tarnish, coating of an ore, etc.

Mineral Dressing Notes No. 24 pictures and describes quick, easy techniques for mounting, polishing and examining samples of mill products, minerals and ores. Using full-color photomicrographs of South American mill samples, this informative publication shows interesting and unsuspected mineral combinations revealed by the microscope and discusses the metallurgical problems and solutions involved.

An automatic counting and recording device built by the author, E. P. Cadwell, to determine the mineral make up of briquetted and polished samples is described in detail.

This new issue of Cyanamid Mineral Dressing Notes will be a valuable addition to your technical reference bookshelf. Send for your copy to our nearest office or to New York.

Please send copy of Mineral Dressing Notes No. 24, without cost or obligation.

NAME: _____

COMPANY: _____

ADDRESS: _____

_____

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
160 Bloor Street East, Toronto 5, Ontario, Canada

CYANAMID DE MEXICO, S.A.
Apartado Postal 588 Mexico 1, D.F., Mexico

CYANAMID OF GREAT BRITAIN LTD.
Bush House, Aldwych, London W.C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
P.O. Box 7552, Johannesburg, Union of South Africa

E. P. CADWELL
Casilla 4288, Bolen 1049, Of. 7, Lima, Peru

CYANAMID AUSTRALIA PTY. LTD.
"Collins Gate" 377 Little Collins Street Melbourne, Australia

Cyanidation Process Chemicals
Flotation Reagents
Flocculating Agents
Film Forming Agents
Surface Active Agents

High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Powder
Blasting Caps
Electric Blasting Caps
Blasting Accessories

Philadelphia Gear announces . . .

a major breakthrough to new standards in precision grinding of speed reducer gearing . . . *So advanced* that conventional standards of accuracy have suddenly become out-of-date. *So significant* that you can solve drive problems you could never solve before . . . because you get engineering advantages that have never been available before.

IMPROVED ACCURACY

For the first time, standard commercial speed reducers are available with gearing of master gear quality.

LONGER LIFE

Extreme accuracy of profiles, profile spacing and surface finish completely eliminates "running in" periods and resulting wear on gearing.

REDUCED BACKLASH

Precision ground gearing means reduced backlash for reversing drives . . . plus uniform backlash where precision of movement is important.

100% INTERCHANGEABILITY

Duplicate units or spares can be installed with original manufacturing tolerances duplicated exactly.

SPACE AND WEIGHT SAVINGS

Use of harder materials plus reduced load factors save weight and space without sacrificing performance characteristics.

REDUCED VIBRATION

Reduced tooth to tooth errors, accumulated pitch errors and total composite errors give smoother contact.

HIGHER SPEEDS

Dynamic load factors are materially reduced. Reducers can operate at higher speeds . . . have increased load carrying capacity.

REDUCED NOISE

For any application where low sound levels are important, gearing noise is no longer a controlling factor.

IMPROVE YOUR PRODUCT

Philadelphia precision gear drives may give your product the years-ahead competitive edge you've been looking for.

Write today for complete information

philadelphia gear drives

PHILADELPHIA GEAR CORPORATION

Erie Avenue and G Street • Philadelphia 34, Pennsylvania

Offices in all Principal Cities • Virginia Gear & Machine Corp., Lynchburg, Va.

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

You can keep all your equipment on the job with only 6 Texaco Lubricants

Modern mining equipment embodies a multitude of complex parts. But you don't have to have a multitude of oils and greases to keep it running. With a Texaco Simplified Lubrication Plan—tailored to your exact needs—you can do the job with as few as 6 lubricants.

Think what that means in terms of:

Smaller lubricant inventory

Reduced chance of application error

Insurance of longer periods of uninterrupted production

Lower maintenance costs

Planned lubrication schedules in every Texaco Simplified Lubrication Plan make good maintenance practice easy and certain. And equipment lasts longer because top grade lubricants lengthen its life.

Hydraulic systems, for example, are charged with Texaco Regal Oil R&O. This premium hydraulic oil is far more than a physical medium for transmitting power. It also lubricates pumps, cylinders and other system components. Texaco Regal Oil R&O contains special additives that assure resistance to oxidation, sludging and foaming, and prevent wear and rust—the best guarantee you can get for precise control and longer uninterrupted operation.

Find out exactly how a few Texaco lubricants can keep all your equipment running efficiently. Call the nearest of more than 2,000 Texaco Distributing Plants in all States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

A NEW KIND OF

"Circle-Set" design offers unique

Diamond Core Drill Manufacturers • Core Drilling Contractors

DIAMOND BIT from Longyear

combination of core drilling advantages

The new Circle-Set bit—developed by Longyear—is designed with diamonds set in concentric ridges. These rings cut V-shaped grooves in the rock. Pressure of the diamonds against the sides of these grooves breaks away substantially larger cuttings than conventional bits would make in the same rock. The design is patented.

Here are the proven advantages of the Circle-Set bit design

1. FASTER PENETRATION—The Circle-Set design produces relatively large cuttings and provides for rapid removal of cuttings from the bit face.

2. LONGER BIT LIFE—Less bit pressure is needed for good penetration because the Circle-Set design makes it unnecessary to cut the rock into extremely fine particles. Diamonds are oriented in a hard vector direction, giving more cutting per unit of diamond wear.

3. LOW FIRST COST—Fewer diamonds are needed for good cutting action because the design makes large cuttings break away easily from the sides of the grooves.

4. LOW COST PER FOOT—Faster penetration, good footage and lower carat weight combine to reduce drilling costs substantially.

5. HIGH BIT SALVAGE VALUE—Diamond losses are lower since the diamonds are oriented in a hard vector direction and supported by metal in the ridges.

6. GREATER STABILITY—Core barrel and drill string vibration is often noticeably reduced since concentric rings on the face ride *inside* the grooves cut in the rock.

7. IMPROVED CORE RECOVERY—Core recovery is improved in many formations because this stability and the sharp I.D. corners help cut the core cleanly away from the rock.

8. REDUCED NEED FOR HIGH BIT INVENTORIES—The Circle-Set bit's one basic design does well in many drilling conditions.

9. POPULAR SIZES AND TYPES ARE AVAILABLE FROM STOCK.

Because Circle-Set bits can reduce costs while other drilling expenses continue to increase, they are destined to become important in many diamond drilling operations.

For complete information and prices of Circle-Set bits, write:

E. J. LONGYEAR COMPANY

76 South 8th Street • Minneapolis 2, Minnesota

CANADIAN LONGYEAR, LTD., NORTH BAY, ONTARIO

LONGYEAR, N.V., THE HAGUE, HOLLAND

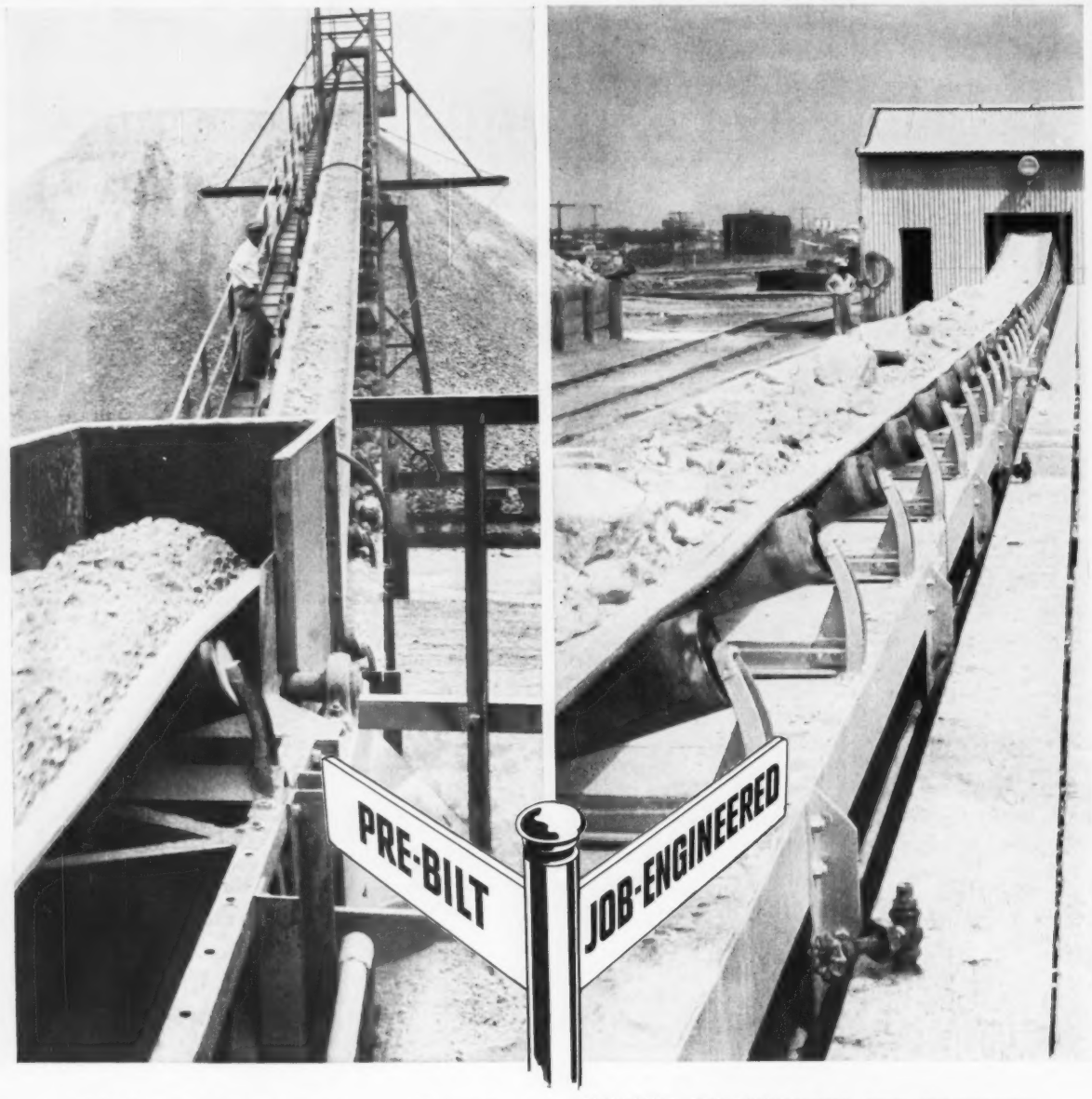
LONGYEAR ET CIE., PARIS, FRANCE

• *Mining Engineering and Geological Consultants*

Longyear

THE WORLD IS OUR WORKSHOP

Choose your route to lower handling costs



Modernize for greater profit with a LINK-BELT belt conveyor system

BELT conveyors have proved themselves the giant of industry for low-cost, bulk materials handling. And additional benefits offered by Link-Belt contribute even more to this inherent economy.

LINK-BELT PRE-BILT SECTIONAL BELT CONVEYORS are pre-engineered . . . avoid need for detailed drawings. From standardized data, Link-Belt engineers prepare "on-the-site" quotations. Interchangeable, standardized parts speed selection, reduce purchasing costs.

LINK-BELT JOB-ENGINEERED BELT CONVEYORS. As a single source for design, equipment and erection of these systems, Link-Belt spares you coordination problems involving drawings and equipment . . . prevents waste of your engineering manhours.

For full details on both types of conveyors, contact your nearest Link-Belt office. Ask for 40-page Pre-Bilt Catalog 2779. 15.022

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

SPEEDS UP HAULING 4 WAYS

The Athey PR21 Rear Dump Trailer cuts valuable minutes from your hauling cycle—with a unique set of "efficiency features."

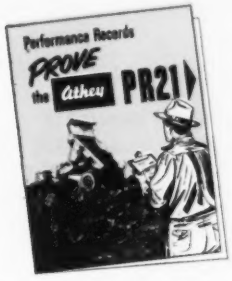
MANEUVERING: No repeated backing up! Thanks to PR21's 90° turning ability, you can whirl it into place, even in cramped quarters.

LOADING: Body provides a big easy target for shovel! Even big, bulky rocks can be loaded fast.

HAULING: Full 22.5 yds. per trip, at speeds as high as 27.9 mph.

DUMPING: Dumps at high 60° angle, out of a straight-line body interior. Clean, fast...no "hangup."

SEND TODAY for this informative new folder!



FREE booklet shows how others have stepped up production with the Athey PR21 Rear Dump.

Athey

PRODUCTS CORPORATION
5631 West 65th Street
Chicago 38, Illinois

PR21
REAR DUMP
TRAILER

Designers and Manufacturers of Heavy-duty Loading and Hauling Equipment

DOW | Recovery Chemicals Improve Profit Picture

It is elementary that as a mining company's recovery processes improve, so will the profit picture improve. Difficult separations, concentrations and collections are being solved daily by new and better chemicals. The balance sheet looks better as recovery improves, and these brief chemical notes will help stimulate ideas on making the company's net income bigger.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

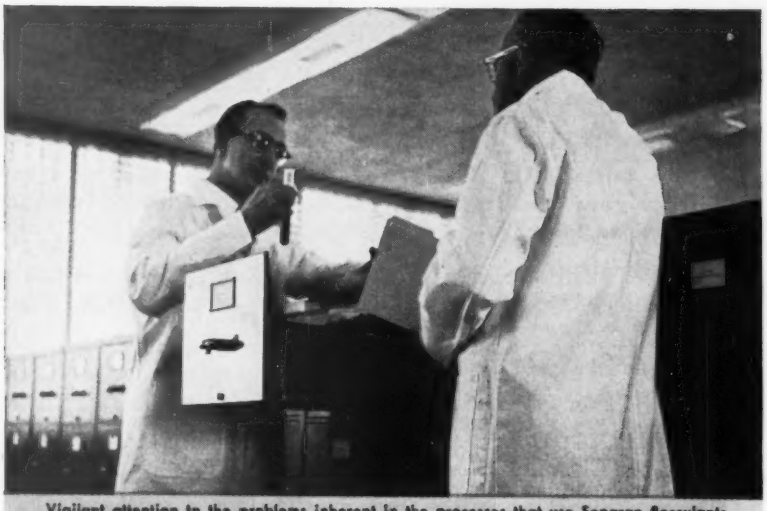
_____

_____

_____

TECHNICAL EXPERIENCE ADDS EXTRA DIMENSION TO DOW FLOCCULANTS

Separan® NP10 and Separan NP20, extremely speedy and versatile high molecular weight organic flocculants, are performing well for the mining industry. As a result, Dow's Tech Service Team has obtained a wealth of information and experience dealing with tricky liquid-solid separations. This experience makes them a willing target for hurried calls from all over the globe.



Vigilant attention to the problems inherent in the processes that use Separan flocculants has given Dow's Technical Service Team a wealth of data and information on flocculation. This collective information has helped solve many a perplexing situation.

Flocculants such as lime, glue and starch have long been used by the mining industry to improve liquid-solid separations. Since new organic materials replaced these substances in the early 1950's, the expert in the new field of faster and more thorough flocculation has been in great demand.

Dow's Tech Service Team has spent a busy five years. As Dr. Herbert Dow, Dow's founder, once remarked, "Chemicals are a good deal like little boys. In the laboratory they act like angels. Outside the laboratory, they can be devils!" Dow knew how Separan flocculants would act in the laboratory, but the key question, of course, was—what will they do in actual field applications?

The answer: Better than the most optimistic dared hope for. But experienced mining men remained skeptical. They had to be shown they would do a better job in their own backyard.

So, from the start, the Separan product was on its own. And looking back over the past five years, Separan NP10 has done its job well while convincing the skeptics. At the same time, this unusual product has also taught the men that went with it a great deal.

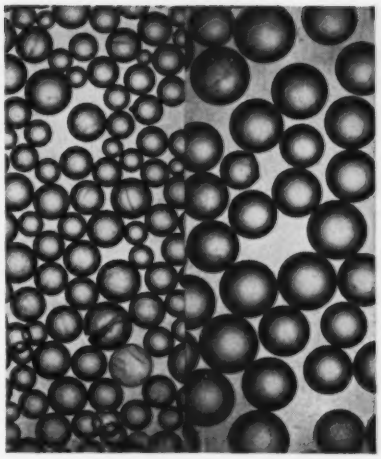
Typical examples of experience. Dow has extensive files on Separan NP10 as used in uranium mills for a variety of difficult liquid-solid separations ranging from clarification of pregnant liquors to the filtration of "yellow cake." The uranium leach problems are, of

course, similar to those of other leaching operations. Gold cyanidation is another process which presents similar problems where Separan finds use. Case histories also are available in settling, thickening and filtration situations in nickel recovery operations. Flotation plants, too, use Separan flocculants for thickening and dewatering concentrate and tailing.

More unique examples. Separan NP10 has been successfully used as an electrolyte additive in the electrolytic recovery and refining of metals. It's also being used for the recovery of flue gas solids in a number of scrubbing plants and in aiding the removal of solids from mine waters before pumping. Clarification of raw river water is another interesting application.

In the beginning, Dow could only offer the product and explain what it could do. Now, five years' experience has taught Dow and many customers just where and how Separan flocculants can improve processes and save precious recovery dollars.

It has often been said you can only learn by doing. And "doing" has surely added another dimension to Separan flocculants. When you need a fast-acting flocculant, call Dow. You'll also get some of the best technical service in the business.



21K 21K RIP

These two ion exchange resins (Dowex 21K and Dowex 21K RIP) lead the way in hard-to-manage recovery situations. Dow's technical assistance plays a major role here.

ION EXCHANGE RESINS crack tough recovery problems

Expensive and hard-to-manage recovery problems are being licked daily by the use of ion exchange resins. Dow has for years made such resins which are sold under the trademark Dowex®. This family of resins has two particular members of most interest to mill men. Both Dowex 21K and Dowex 21K RIP were developed with mining applications in mind. Their properties suit them well for concentrating metals. These two products are particularly well adapted to the treatment of extremely dilute solutions where other processes such as evaporation and precipitation fall down. At this time, they have proved very successful in concentrating uranium. As in the case of Separan flocculants, Dow's technical experience with ion exchange resins adds another dimension to these materials.

NEW MEXICO added to Caustic supply network

Grants, New Mexico, was recently added to Dow's complex system of distribution of caustic soda 50% solution. Basic production is divided among five different plants, and eight terminals in addition to Grants, N. M., provide fast service for this versatile "workhorse" chemical.

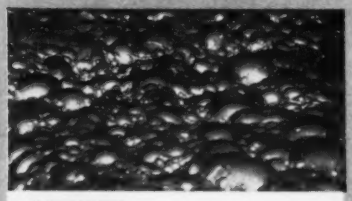
The uranium industry has found profit in using caustic to precipitate uranium from pregnant solution. Other stimulating ideas are to be found in Dow's exhaustive 86-page handbook on Caustic Soda. Copies are immediately available.

* * * *

For further information, booklets, technical papers and other literature on any of these products or others, contact your nearest Dow sales office or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Dept. 931BD4.

Four more chemicals offer

PROFIT POSSIBILITIES



DOWFROTH

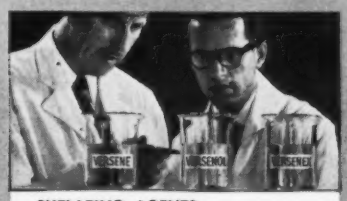
Dowfroth® 250 and 400 offer a choice of two products for frothing. Excellent properties: Froth is mobile on the cell and breaks down readily in the launder.

XANTHATES

Nine different xanthates afford mill operators an opportunity to be very selective in their choice of collector . . . indispensable chemicals in the recovery of minerals.

Z®-200

The newest product in flotation reagents. Here's a tailor-made, unique collecting agent for copper minerals and copper-activated zinc minerals where rejection of pyrite is important.



CHELATING AGENTS

The family of Versene® products offers the mining industry the most complete line of chelating agents. Efficient and economical to use as filter cloth cleaner and descaler.

Dow Chemicals basic to the mining industry

Flocculants • Ion Exchange Resins
Preservatives • Chelating Agents
Ammonia • Solvent Extractants
Muriatic Acid • Frothers • Collectors
Chlorine • Calcium Chloride
Alkalies • Flotation Agents

THE DOW CHEMICAL COMPANY
Midland, Michigan

DOW

Rear-Dump "Eucs" have payload capacities of 10 to 50 tons—are powered by engines of 128 to 670 total h.p. . . . have loaded speeds up to 41 mph.

Check Euclid Performance for Lower Hauling Costs

Leading contractors, mines, quarries and industrial users of heavy earthmoving equipment the world over have standardized on Euclids for tough off-highway hauls. They know from years of experience on their own operations that "Eucs" get more work done every shift — that production cost is lower than with other types and makes of equipment.

Euclid has a complete range of sizes and models to fit every job requirement — rear dump and bottom dump haulers, self-powered scrapers and the world's most powerful crawler tractor. Your Euclid dealer will be glad to provide a production-cost estimate on your present or planned operations — be sure to see him before you replace or add to your equipment fleet — and have him show you why Euclids are your best investment.

EUCLID Division of General Motors Corporation
Cleveland 17, Ohio

Bottom-Dumps carry payloads of 13, 17 and 25 cu. yds. struck . . . are powered by 218 to 335 h.p. engines . . . have top speeds up to 34 mph. Full length, unobstructed door openings make these "Eucs" ideal for dumping free-flowing material into drive-over hoppers.

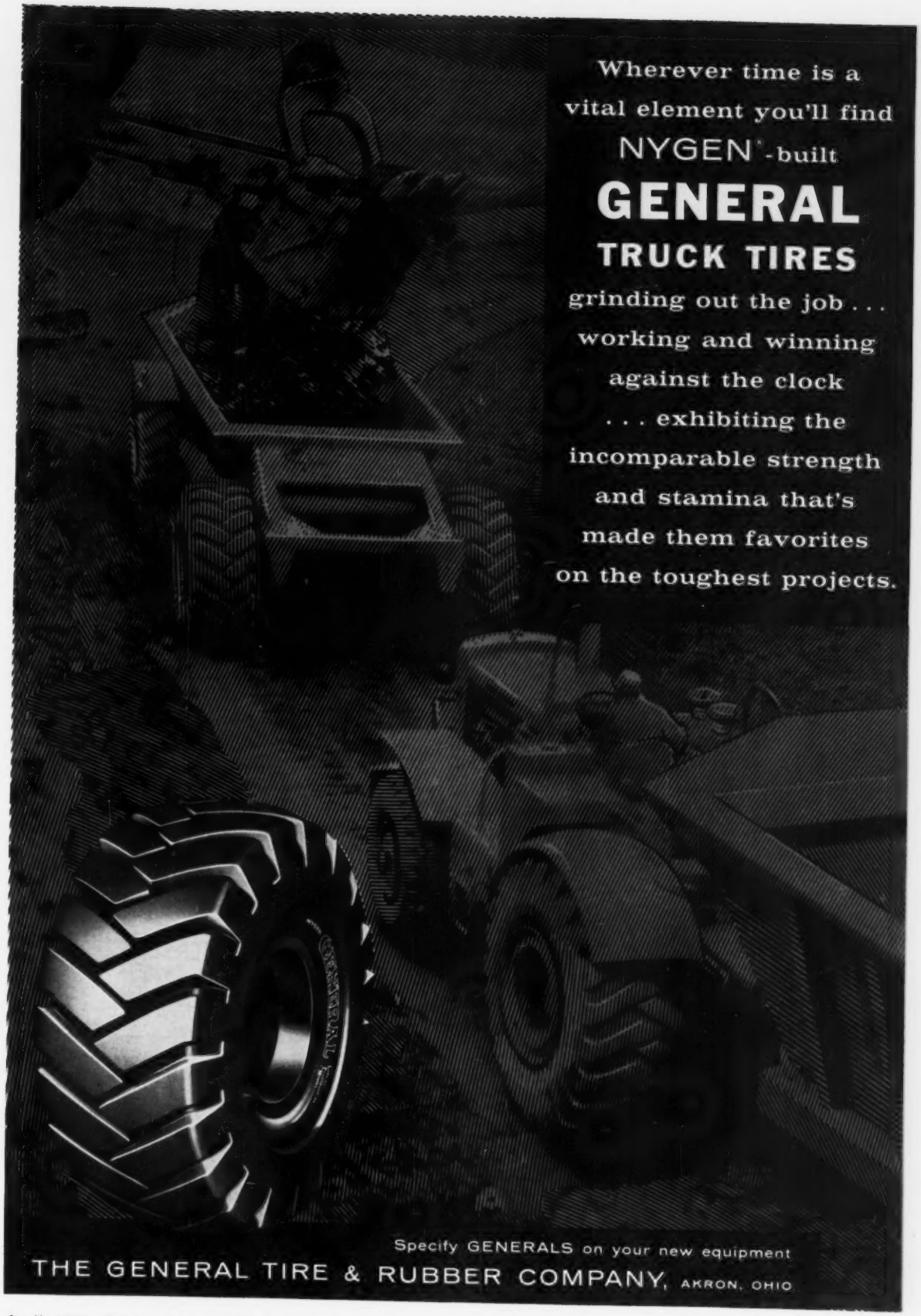
The TC-12 Crawler has 2 engines and independent track-drive . . . 402 net h.p. . . . full power shift . . . top speed of 7.8 mph. This "Euc" tractor has unequalled work-ability for heavy dozing, ripping and similar work in construction, mining and logging.

This "Twin" Scraper has 2 engines with Torqmatic Drive . . . all wheel drive permits self-loading . . . struck capacity is 24 cu. yds. There are six other Euclid Scrapers, overhung engine and six wheel types, with struck capacities ranging from 7 to 24 yds.—9 to 32 yds. heaped.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE


Wherever time is a
vital element you'll find
NYGEN®-built
GENERAL
TRUCK TIRES
grinding out the job . . .
working and winning
against the clock
. . . exhibiting the
incomparable strength
and stamina that's
made them favorites
on the toughest projects.
Specify GENERALS on your new equipment
THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

Improved, Republic RS-1 Expansion Shell

WIDE, STURDY LEAVES and flaring inside taper—extra strength in relatively soft formations.
STRONG, YET FLEXIBLE for simple installation and quick, efficient tightening.
NARROW BASE SUPPORT for the leaves assures easy expansion during installation.
NEW, HEAVY-DUTY SUPPORT NUT holds shell firmly in position before final tightening.

EXTRA STRONG ALL PURPOSE SHELL

For Easy Installation in Strata of Any Type

In the panel at left, you can quickly check features of Republic's new, improved RS-1 Expansion Shell. It is only one of Republic's many advanced mine roof bolting products.

To hold any type of mine roof or rock strata safely and economically, Republic offers the largest combination of roof bolts, roof plates, and expansion shell assemblies available. They can be used in hard rock metal mining, soft rock operations, or to provide support in tunnel work, miscellaneous foundation work, rock cuts, and similar projects.

For more information on Republic's complete line of roof bolt assemblies, or for engineering assistance, contact your Republic representative, or mail coupon.

REPUBLIC DO-NUT ROOF BOLT PLATE
EMBOSSED DESIGN provides extra strength and increases pressure area. Self-centering, and gives maximum holding power with no loss of headroom. (Plates also available in other types, various sizes.)
REPUBLIC SQUARE HEAD MINE ROOF BOLT
FORGED WASHER provides a smooth bearing surface larger than bolt head.
SQUARE HEAD cleanly forged as one piece with washer. Unchamfered to give solid surface for tight wrench fit.
LENGTH IN INCHES is plainly marked on head of every Republic Mine Roof Bolt.

MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

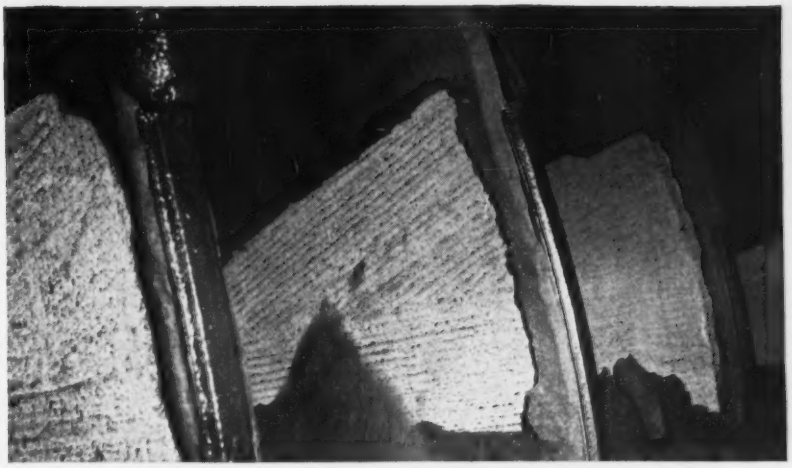
HEAT NO.	YIELD POINT (PSI)	YIELD POINT (POUNDS)	BREAK POINT (POUNDS)

The above figures are correct as contained in the official records of the Corporation.

BY _____
CHIEF METALLURGIST, BOLT AND NUT DIVISION

REPUBLIC STEEL CORPORATION
General Offices · Cleveland 1, Ohio

MATERIAL CONTROL CERTIFICATE FURNISHED BY REPUBLIC with every roof bolt shipment gives specific physical properties of the steel used. Guesswork and assumptions about performance are eliminated. Specific performance data for the heat, or heats, of steel used are indicated, including the mill order number, heat number, yield point in pounds per square inch, yield and break point in pounds for the size of the bolts.



REPUBLIC STAINLESS STEEL OFFERS MINING ECONOMIES. Performance efficiency of this disc-type filter was increased two ways when cotton cloth was replaced by Republic ENDURO® Stainless Steel screen. First, much smaller fines were recovered. Second, intervals between filter replacement were extended many times. Republic ENDURO Stainless Steel is ideal for a wide variety of mining equipment applications. Send for data.

REPUBLIC ELECTRUNITE® GROOVED-END CARBON AND STAINLESS TUBING offers cost- and time-saving advantages in many mining and construction applications. Quickly and easily joined with Victaulic Coupling, grooved-end tubing is ideal for air, water, drainage lines, in highway, tunneling, and other heavy-duty operations. As work moves ahead, lines can be taken up and relaid to conform to changing needs. Republic Light Weight ELECTRUNITE Tubing is engineered and produced to meet severe service and laying conditions. For full information, mail coupon.

REPUBLIC HIGH STRENGTH STEEL IMPROVES SERVICE LIFE for many types of mining equipment. In mine car and hopper car use, for example, its superior strength and resistance to corrosion greatly reduce maintenance costs. Republic High Strength Steel also provides good impact and abrasion-resistance. It will pay you to evaluate all of these advantages in terms of your equipment performance specifications. For more information, mail coupon.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

SEE OUR BOOTH, #1100, AT THE COAL SHOW

REPUBLIC STEEL CORPORATION
DEPT. EJ -7566
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ Mine Roof Bolts ☐ Grooved-End Tubing
☐ High Strength Steel ☐ ENDURO Stainless Steel

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

One P&H sells another because
P&H "PROFIT·TONS" reduce quarrying costs all day...every day

More responsive dipper action, as much as 30% more bail pull, faster swing and *maximum* availability all add up to lower cost per ton—more net profit for users of P&H Electric Mining Excavators.

As much as 10% more production with P&H Electrics in leading mines and quarries throughout the world is the end product of patented *exclusive* P&H design principles.

MAGNETORQUE® . . . the most advanced hoist drive known for electric excavators. This hoist drive electro-magnetically transmits digging power from an A.C. hoist motor direct to the dipper. It provides higher bail pull and faster dipper fill with an *exclusive* degree of protection for the hoisting machinery from digging stresses.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators, it accomplishes the fastest work cycles known. This closed circuit, adjustable energy system has no moving parts, and offers reductions in control maintenance expense of as much as 80%.

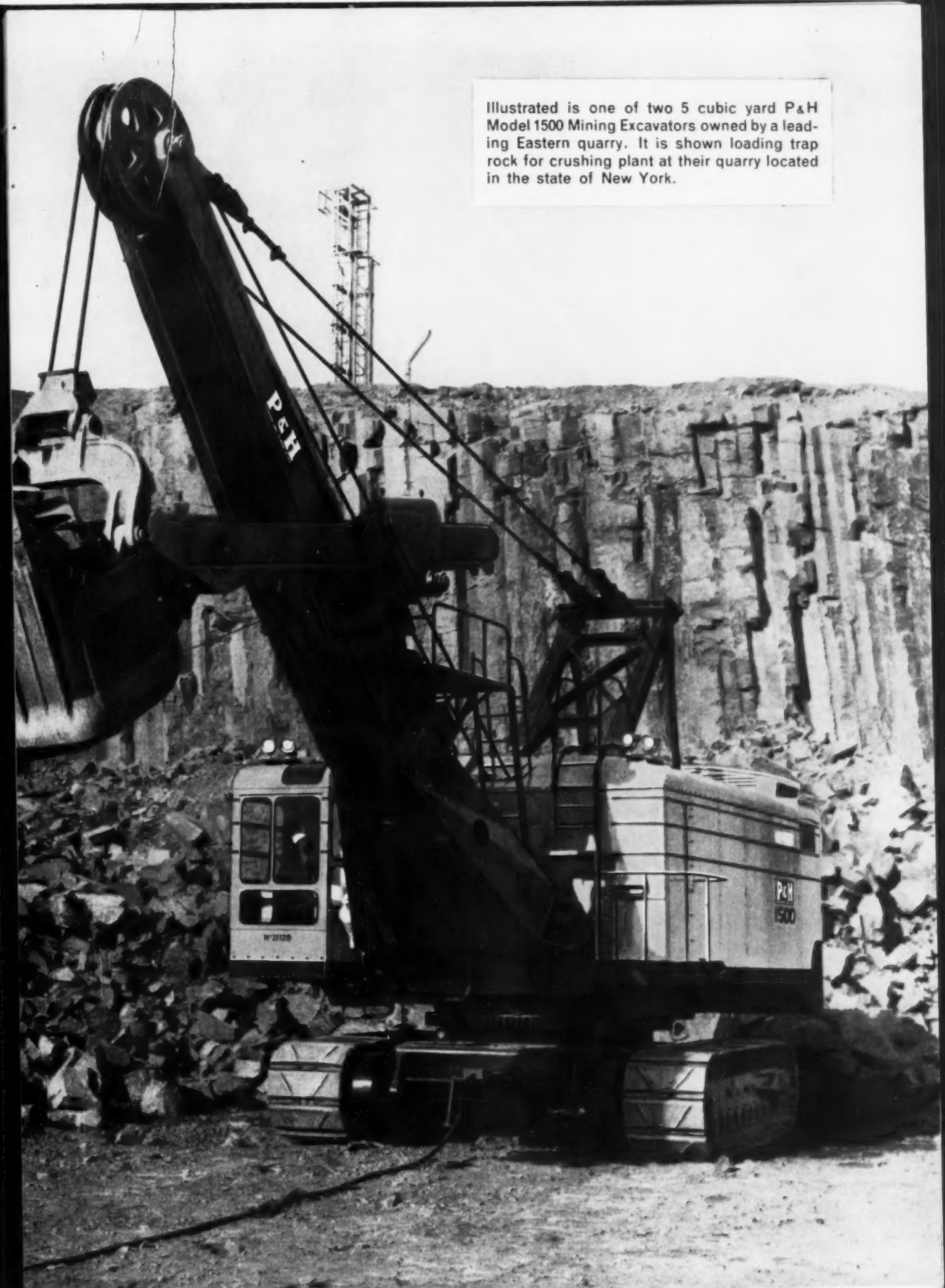
Also, with P&H you get single source responsibility—an exclusive advantage experienced only by users of P&H Electrics. P&H manufactures their own electrical equipment—*designed specifically for electric shovel service*—as well as mechanical equipment.

P&H MINING EXCAVATORS

OUR 75TH YEAR

HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

P&H MINING EXCAVATOR LINE: 3½ through 10 cu. yd. capacities



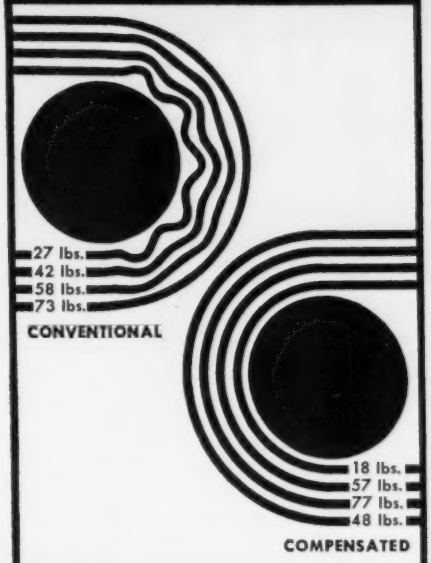
Illustrated is one of two 5 cubic yard P&H Model 1500 Mining Excavators owned by a leading Eastern quarry. It is shown loading trap rock for crushing plant at their quarry located in the state of New York.

RAY-MAN CONVEYOR BELT
Lasts Longer on Tough Hauls

R/M engineering makes the difference with Ray-Man Conveyor Belt. Cushioned strength members give it the resiliency to take the impact of shock loading . . . the flexibility to train better, trough naturally. Balanced *Double*-Compensation relieves outer ply stresses, prolongs belt life under the most rugged operating conditions. R/M's exclusive "XDC" Cover gives Ray-Man extra protection against wear, tear, cuts and abrasion never before possible.

Ray-Man Conveyor Belt is rip resistant. It requires no breaker strip . . . holds fasteners far better than other constructions. Like all R/M heavy duty conveyor belts, Ray-Man is both moisture resistant and mildew-proof. Let an R/M representative show you the engineered advantages of Ray-Man Conveyor Belt and other R/M constructions . . . extra-cushioned Homocord for unusually severe shock loading . . . R/M Tension-Master for extra long lifts, high tensions. Write for Bulletin M302.

STRESS-RELIEF OF OUTER PLIES MEANS LONGER BELT LIFE... "More Use per Dollar"



CONTROLLED PLY ELASTICITY

Note how Double-Compensation at right equalizes ply stresses.

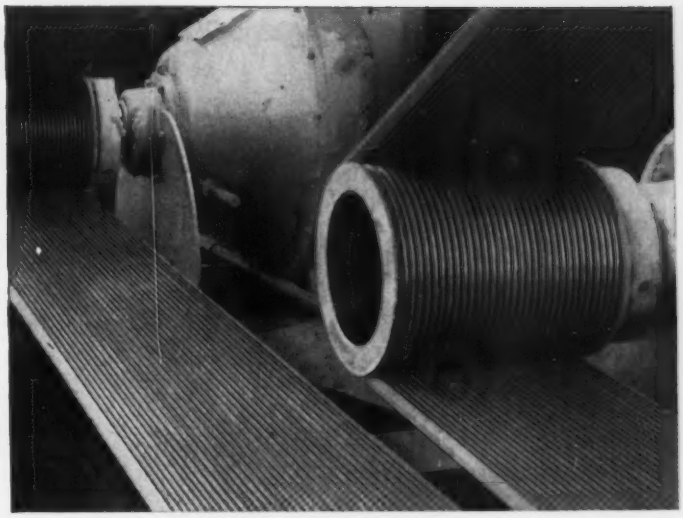
1. Center plies on neutral axis and better protected carry more load.
2. Outer plies stress-relieved by adjusting to tension and compression.

INDUSTRY'S *ONLY* COMPENSATED BELT

Ray-Man Compensation relieves outer ply stress . . . allows outside ply to elongate more than inner plies as the belt flexes around the pulleys. Inner plies no longer "loaf", but carry full share of the load.

Outer ply is better able to absorb strain and impact of loading, pull as a strength member, *protect* the inner plies, hold fasteners or splice longer.

And, because Ray-Man is *double Compensated*—both top and bottom plies stress-relieved—Ray-Man Compensation prolongs belt life, even where operated over reverse bend, snub or take-up pulleys!



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A single unit belt across full width of the drive sheave . . . not an assembly of V-belts . . . gives patented Poly-V twice the tractive surface to deliver up to 50% *more* power in the same space as a V-belt drive — or *equal* power in ⅔ the space! Multiple-belt "matching problems" are eliminated . . . equipment downtime and belt replacement costs reduced to a minimum. Poly-V assures constant belt speed ratios from no load to full load to provide the smoothest and coolest running—longest wearing drive for your heavy duty power driven equipment. Just two Poly-V* belt cross-sections meet every requirement! Write for Bulletin M141.

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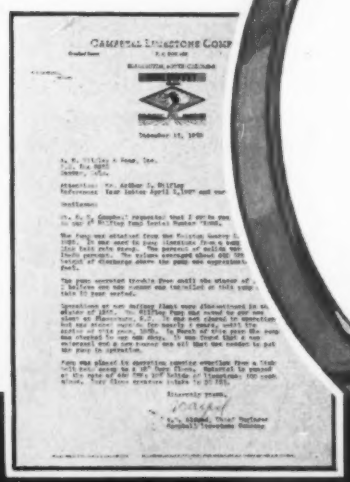
A Wilfley customer reports the following:

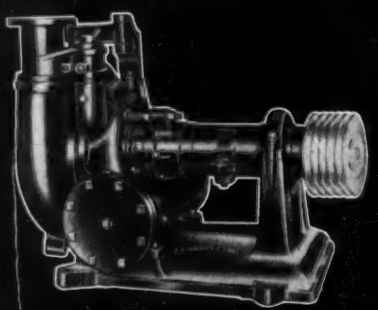


"The pump operated trouble free until the winter of 1953. I believe one new runner was installed on this pump during this 20 year period.

It was not placed in operation, but was stored outside for nearly 4 years until the spring of this year, 1958. In March of this year the pump was checked in our own shop. It was found that a new water-seal and a new runner was all that was needed to put the pump in operation."

Year after year Wilfley's reputation for dependable, low-cost pumping continues to build.

Individual engineering on every application.



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ENGINEERING AND MINING JOURNAL

APRIL 1959

The "Cold War" of the States

"LOOKING AT THE OVER-ALL SITUATION, we must face the acknowledged fact that the forty-nine states of America are engaged in a 'cold war' for the nation's industrial expansion. It is a free market. The competition is keen, and only those states determined to make an all-out effort will stand in the winner's circle." When C.F. Hood, president of U.S. Steel Corp., made this statement at the recent Conference on Jobs and Business Climate in Pennsylvania, he was speaking about industry in general.

But his remarks are just as applicable to the mining industry. The only qualification that need be added is that states which are bidding for new mining projects are not only in competition with each other, but with nations all over the world as well. When you recall the hundreds of millions of dollars that are being spent to develop low-grade iron ore deposits in Canada, and high-grade deposits in Latin America and Africa, the latter statement needs no amplification.

What attracts a mining enterprise to a particular state or area? Mr. Hood's answer: It's climate — favorable economic climate! This is defined by Mr. Hood as follows: "A good business climate, briefly defined, is the net result of all those outside conditions which permit a business to operate in the best interests of its employees, customers, owners, the community, state and nation." Too many states recognize only two beneficiaries —the state and the community— and this is where they start to lose the "cold war" of the states.

Excessive taxes on minerals in the ground, high separation taxes, extreme conservationist legislation are all fine for the state and the community on a short-sighted basis, but such items disregard the best interests of the employee, the customer, the owners and the nation. It is this disregard that shunts desirable mining projects away from state borders, just as surely as if state laws had banned them deliberately.

The following news items point up the migration of mining ventures to favorable areas, also indicate why some areas are avoided.

VIRGINIA, Minn. March 1959—R.T. Elstad, president of Oliver Iron Mining Division; Harry F. Kullberg, general manager of Minnesota mines for Jones & Laughlin Steel Corp.; and William Montague, attorney for several mining companies, turned down a request from Virginia school officers to support their plans for construction of a new school building. They were told that "the day of excess levies is over." President Elstad said, "We cannot afford it any longer. It is a position I must take. You've got to do it within your levy." Mining companies have seldom before taken so firm a stand against Range-town expenditures for new schools.

QUEBEC-LABRADOR, March 1959—Areas under examination and development in the Quebec-Labrador area include Cyrus Eaton's Ungava Iron Ore Co. on Ungava Bay, which is a joint Cleveland-Cliffs, International Iron Ores, Steep Rock and Krupp operation; Oceanic Iron Ore of Canada, a Rio Tinto venture; Consolidated Fenimore Iron Mines, which reportedly has indicated about 1-billion tons of iron-bearing material; Normanville Mining Co., a Jones & Laughlin and Cleveland-Cliffs company; Iron Ore Co. of Canada, a joint venture by M.A. Hanna Co., Republic Steel Co., Wheeling Steel Corp., Youngstown Sheet & Tube Co., National Steel Corp., Armco Steel Corp., and Hanna Consolidated Gold Mines; Wabush Iron Co., a Pickands Mather & Co. venture; and Quebec Cartier, A U.S. Steel Corp. project.

BIRMINGHAM, March 1959.—The first round in a proposal by Republic Steel Co. to mine Red Mountain, near Birmingham, was defeated in early March when the city's zoning board unanimously refused to rezone the presently-residential area for mining. Republic appeared with a citizens group which cited economic benefits of opening up the iron ore deposit, and offered to donate a park to the city between the proposed mining area and other residential areas.

PEA RIDGE, Mo. March 1959—At Pea Ridge, Meramec Mining Co., owned jointly by Bethlehem Steel Co. and St. Joseph Lead Co., is making satisfactory progress towards entering production by the latter part of 1962, with an installed capacity of 2-million tons of high-grade pellets annually.

MICHIGAN, Nov. 1958 — Bear Creek Mining Co. (Kennecott exploration subsidiary) is attempting to obtain a lease from the state of Michigan permitting it to search for, and possibly mine, copper in the Porcupine State Park.

MICHIGAN, Jan. 1959—Despite strong pressure from a number of residents in Michigan's Upper Peninsula, Bear Creek Mining Co.'s request for a lease in Porcupine State Park will be turned down by the State Conservation Commission. The commission chairman, who heard residents ask for the lease as a help to depressed employment, and also heard leading conservationists oppose the grant, has recommended refusal by the commission.

MICHIGAN, Nov. 1958—Michigan at present is in sixth place as a copper producer in the U.S.

TINTIC, Utah, March 1959—One of the current more interesting current investigations by Kennecott Copper Corp. involves an exploration program underway at Tintic, a mining district with a long record of past production of lead, zinc and silver.

DENVER, Colo. Feb. 3, 1959—Is mining paying its fair share of taxes in Colorado? A multi-million dollar question. But there is no answer because nobody has ever gathered the facts necessary for a really honest comparison between taxes paid by mining and taxes paid by other segments of the economy, legislators were told yesterday.

QUICK 35-FPM PASS of special head on standard oxy-acetylene torch prepares metal surface for better and faster paint job.

Flame-Priming Improves Metal Painting

G. H. MORGAN

"FLAME-PRIMING," a process perfected by Linde Co., offers the mining industry a simple, fast, low cost way of properly preparing a metal surface for painting. In both mine and mill, practically any metal surface can be flame-primed so as to improve the quality, corrosion resistance and life of the coating. In remote mining areas, the simplicity and portability of equipment is a particular advantage.

"Preparation of surface is equally as important as the painting itself" is a truism repeatedly proven by research into protection of surfaces by painting. Specifically, a steel surface should be cleaned of loose scale, rust and contaminants and should be dry and warm because even a one-molecule surface layer of moisture or other incompatible material can prevent proper bonding of the paint and can also permit continued corrosion under the paint.

Flame-priming consists of "scrubbing" steel surfaces with a series of closely spaced oxy-acetylene flames that have an extremely high temperature and velocity. As a result, all mill scale that is not tightly bonded is popped loose by sudden thermal expansion. The physically absorbed and chemically combined water is driven off from any rust that is present, leaving stable oxides in their place. At the same time other contaminants such as oil and acid salts are consumed or disintegrated by the flames. The surface is then wire brushed free of loosened foreign material and/or painted while still warm.

The process not only brings about improved corrosion resistance of the paint coating, but also increases cleaning and painting rates and reduces setting time for the paint. As a further advantage, painting can be carried out under conditions of low ambient temperature or dampness which would otherwise cause major delays. The time saved with the process is of particular importance when continuous production without delays in the fabrication and painting of steel is required.

Equipment Is Uncomplicated

The heating action in flame-priming is produced by flame-priming heads, ranging in widths from 1 to 12 in., which can easily be attached to standard welding blowpipes, either directly or by means of an extension arm. The entire unit is light, well balanced, and easy to handle. The head is protected from wear or damage in use by means of hard-faced wear pads and skids, which also serve to keep it automatically at the correct distance from the work.

A 6-in. head, the size most frequently used, has 49 flame ports that are spaced ⅛-in. apart, and are No. 75 drill size, or approximately 20 thousandths of an inch in diameter. Despite this extremely small diameter, the flames are over ¼-in. long, indicating the extremely high velocity of

(*Continued on p 88*)

Mr. Morgan is a sales engineer with Linde Co., a division of Union Carbide Corp.

Where Sigma Mines Uses Flame-Priming

An excellent case history of flame-priming is at Sigma Mines (Quebec) Ltd., Bourlamaque, Quebec. All pictures accompanying this article were taken at the mine. Prior to adopting the process in 1949, Sigma Mines spent a good deal of money using other methods without any marked degree of success. Initially, flame-priming was used in connection with corrosion of such vital equipment as thickener and agitator tanks and their superstructures. However, it has since been found very effective underground for mine skips and cages, pipelines, air receivers, ventilator fans and similar equipment. Wherever possible, new underground installations such as air lines, shaft station gates and fire doors are flame-primed and painted on the surface before installation; but, where necessary, the scheme is also used on underground installations already in place.

Specific uses and performance of flame-priming in the mining industry can be illustrated by the various applications at Sigma Mines:

Surface Air Receivers. Previously these were wire-brushed and painted annually. But after being flame-primed and painted with Totalum aluminum paint the refinishing period was extended to three or more years.

Air Intake Fan. After being flame-primed and painted with an anti-corrosive red the steel-plate footings of the air intake fan still appeared in very good condition after two and a half years. Before flame-priming was introduced it was the general practice to wire-brush and paint these footings each year.

Mill Agitator Tank. After being flame-primed and treated with an oxide rust preventative this tank still appeared in good condition after two years.

Crushing Station, 15th level. The structural steel chutes, stairways, etc., showed no sign of requiring retreatment four years after flame-priming and painting.

Underground Fire Door, 15th level. Under normal underground conditions, an untreated door of this type would have to be replaced within not more than three years. After 3½ years this door, which was flame-primed and painted with an anti-corrosive red, showed absolutely no signs of corrosion (see top photo).

Locomotive Battery Boxes. These boxes are being flame-primed and painted with an anti-corrosive grey. The usual life for untreated battery boxes is three years. However, by flame-priming and painting, an extra three years' service is expected.

Mill Surge Tank. This 50,000 gallon tank was flame-primed and treated with an oxide rust preventative. In this application the flame-priming process was found to definitely retard corrosion and cut preventative maintenance costs.

Akins Classifier Rakes. It has been established that flame-priming and painting with an anti-corrosive red will prolong the life of the rakes.

Steel Frame-Work of Oliver Filter. This frame-work was flame-primed and painted with an anti-corrosive red in conjunction with an oxide rust preventative. It has been found that flame-priming significantly reduces corrosion in this application.

Chutes on Surface Ore Bins. Middle photo shows structure being flame-primed.

Underground Air Receiver, 4th level. This receiver was flame-primed and treated with an oxide rust preventative. Since extensive corrosion is encountered underground, flame-priming will probably extend the life of this equipment.

Shaft Station Gates. These gates were flame-primed and painted with an anti-corrosive red. Flame-priming and painting is expected to extend the life of such gates almost indefinitely although the life of an untreated gate is only around four years. Lead photo shows the gates on the 15th level being reclaimed using the flame-priming process.

Skip and Skip-Cage Combination. This equipment is maintained in good condition by flame-priming and painting with an anti-corrosive red.

Thickener Tank. This is an outstanding example of the value of flame-priming. This second-hand equipment had been in use for ten years and as corrosion was very severe there was considerable doubt as to whether the equipment could be reclaimed at all. However, flame-priming and subsequent treatment with an oxide rust preventative turned out a very satisfactory job.

Piping. Bottom photo shows the final stage in reclaiming badly corroded 4-in. pipe which was submerged in a lake for nearly 12 years.

the burning gas jets, which increases the "blasting" effect of the flames and therefore their efficiency. Because of the high velocity of the flames and the design of the flame ports, these flames are extremely resistant to popping or clogging under the most severe operating conditions.

The ready portability of all equipment necessary for flame-priming, including supply sources of oxygen and acetylene, makes the process as suitable for use in the field as it is for shop use. In the shop, oxygen is usually supplied by a piping system and acetylene from a generator, while in the field, oxygen and acetylene are usually supplied from manifold cylinders.

Operation Is Simple

Flame-priming and painting should proceed as a continuous operation. The operator handling the flame-priming blowpipe should be followed immediately by the helper brushing down the surface, who in turn is followed by the painter.

The technique of manipulating the blowpipe is easily learned and requires no special skill. In fact, painters, with no previous experience in using the oxy-acetylene process, have been trained in five minutes to do flame-priming satisfactorily.

Visual observation of the reaction of the steel surface under the priming flames is the real index of the correct speed for blowpipe travel. When rust is present, the formation of a black magnetic powder indicates that the rust has been dehydrated satisfactorily. When the reaction is carried one step further and silvery streaks appear in the black magnetite, it is an indication that the flame-priming is even more thorough than is really necessary. When the problem is merely one of removing loose scale, the desired reaction is readily visible in the "popping off" of the scale. The tendency is to do a more thorough job than necessary.

For the purpose of determining the time it would take to do a certain job, linear speed can be estimated and then multiplied by the head width to get area. The rates of travel for the blowpipe vary depending upon surface conditions and the type of structure. For example, speeds as high as 50 ft per minute have been obtained on relatively new I-beams. However, for estimating purposes it is recommended that the conservative figure of about 35 ft per minute be used. On riveted areas, speed is about half; and when flame-priming is being applied to thick plates that are heavily scaled, speed might have to be reduced to about 15 ft per minute. Very wet surfaces must be treated more slowly than those having dry rust on them.

As for gas consumption, a 6-in. flame-priming head uses about 137 cu ft of oxygen per hr when operated according to recommendations. If the basic speed of 35 lineal ft per minute is attained, the 6-in wide head will treat 1,050 sq ft per hr and use 13 cu ft each of oxygen and acetylene for every 100 sq ft of surface.

Results Are Superior

Rust is an interbonded chemical and physical adsorption of water with iron oxides. A thorough wire brushing alone is not sufficient to prepare a rusted surface for painting, since the physical wetness causes the rust particles to adhere with a persistence that defies brushing. However, flame-priming reduces rust to loosely bonded, granulated powders that can readily be brushed away. This powder is very porous, and, therefore, tends to pick up contaminants as soon as it cools. Because of this "activated" condition, it should be either brushed away before painting or painted while hot. If it is painted hot, its adsorptive characteristics insure its thorough blending into the coat where it becomes a portion of the pigment. It is of the same composition as part of the pigment used in many present day anti-corrosive coatings. In this connection it should be emphasized that the surface should be painted while still warm.

Scale on steel surfaces is a major problem since wire-brushing does not remove all that is loose enough to flake off underneath the paint coat. Flame-priming, on the other hand, forceably removes all scale which can conceivably be considered loose by means of differential expansion between top and bottom surfaces of the scale. However, flame-priming does not remove all scale that, because of its tight bond, would serve as a protection against corrosion. It has been shown that any scale that can resist the stringent expanding action of the sudden heating effect of high-temperature, high-velocity flames is sufficiently tight to resist subsequent flaking. Consequently, an increased protection against corrosion is effected. The tendency for mill scale to give trouble under paint is reduced, while the tightly bonded scale is retained as an added protective measure.

Surfaces exposed to acid atmospheres, such as are often found around roasting and smelting operations, usually have a deposit of salts which, being hygroscopic, tend to pick up and hold moisture. These salts cannot be removed completely by wire-brushing alone, no matter how thorough. By flame-priming, however, moisture is driven out of the salts, leaving anhydrous, granulated salts which can be brushed away, leaving a clean surface ideally prepared to receive the protective coating.

When paint is applied on a warm surface, its corrosion resistance is increased. The removal of contaminants makes it possible for the vehicle to reach the steel surface where the polar attraction forces can exert themselves to produce a greatly increased bonding strength. It is this property which arrests corrosion-creeping. The heat increases mobility and hastens the evaporation of solvents. Since the highest temperature is at the metal-paint interface, the solvents do not tend to be trapped by any skin formation and, consequently, voids and blisters are less frequent. The rate of setting is speeded up by an increase in polymerization of the vehicle caused by the baking action of the heat. This produces a tougher and more lasting film as well as making possible a desirable reduction in drier content.

Distortion of a structural member is not a problem in flame priming. The quantity of heat actually introduced into the base metal is low because of the speed with which the flames are passed over the surface. Of course, the base metal temperature resulting from flame-priming is affected by the thickness of the steel being treated.

The final temperature of a relatively thin plate will, of course, be high when compared with the temperature of a thicker plate subjected to identical treatment. Then too, some structures, such as I-beams, are flame-primed on both sides while others, such as storage tanks are flame-primed on one surface only. Consequently, because of these variations, it is impossible to state the exact temperature of steel surfaces after flame-priming, although in most instances it ranges from 125 to 150 deg F.

However, it has actually been shown that the deflection in a structural member that has been flame-primed is less than that produced by radiant heat from the sun, which causes a continuous temperature difference between the exposed and shaded sides.

Since its introduction, flame-priming has been adopted at many open pits, underground mines and various types of mills. This general acceptance by the mining industry is ample evidence that flame-priming has proven its efficiency, speed and economy in practice as well as theory.

JOHN BALLANTINE KNAEBEL, of the Anaconda Co., left, receives the William Lawrence Saunders Gold Medal for distinguished achievement in exploration and mine development from outgoing president of AIME, Augustus B. Kinzel, right.

AIME Speakers Evaluate Paley Report Predictions

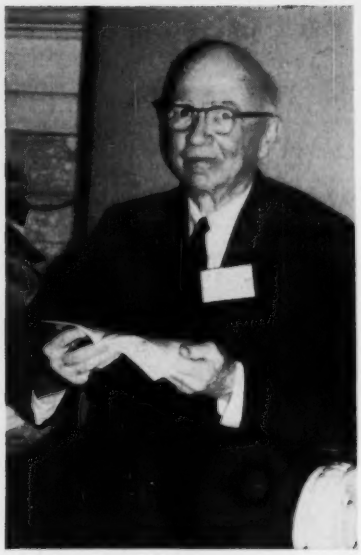
SOME 4,000 MEMBERS and guests turned out for the annual American Institute of Mining, Metallurgical and Petroleum Engineers convention in San Francisco, Feb. 15-19. Papers presented numbered more than 400. An appraisal of the Paley report and the outlook for the mining industry attracted the most popular interest.

Evan Just, consulting geologist, summarized the evaluation of the Paley Report as follows: "Our present abundance and reduced consumption of copper, lead and zinc tend to put the forecasts of the PMPC in a bad light, but the midst of a depression is a poor vantage point for looking forward or back. If we are riding a boom five years hence, we are likely to see the PMPC report as defective for opposite reasons. On balance, the PMPC probably underrated the economic growth of the Free World and overdrew the bogie of scarcity."

"Experience for the next 25 or even 50 years," he said, "will probably demonstrate that the word 'scarcity' was unrealistic. As the better mines are depleted, prices will rise, unless improved methods reduce costs or substitutions occur. We will not reach a condition of scarcity until costs of production are embarrassing to consumers who cannot find effective substitutes. It is very difficult to state what price consumers can pay for things they actually need. Also, substitutes for all the present major uses of copper, lead and zinc are already available, at moderate increases in cost. The use of lead in storage batteries is probably most difficult to replace, nickel and cadmium being less abundant than lead. However, this is a use which permits almost complete reclamation. Lead, cadmium or nickel prices of even $10 per lb would not drive storage batteries out of common use, if an effective substitute for these metals does not become available."

For iron and steel, John D. Sullivan, of Battelle Memorial Institute, summarized the forecasts of the Paley report as follows: "The report covered the national situation as it existed in 1950 and predicted what it would be in 1975. Although it was not intended that its finding should follow a linear intrepretation for a short period, a comparison of the 1957 statistics and 1958 technology with those given in the report shows the general agreement of the actual and predicted status. A comparison of an interpolation of statistical data on the production of ferrous material and on the supply of iron and steel-making raw materials with the

FROM THE NORTHWEST, H. S. Mears, consultant; D. Pifer, University of Washington; L. C. Richards, consultant; and G. H. Waterman of Seattle, Wash.



ARTHUR NOTMAN, consulting engineer of New York studies the program.

actual values in 1957 shows that no gross errors were made. Differences are of degree, rather than kind."

Sullivan predicted that although the direct reduction processes for the treatment of iron ore are in the development stage, and that most large steel companies are investigating the processes, direct reduction will have no impact on the industry before 1965.

Observing that the Paley Report estimated domestic fluorspar consumption in 1975 at 1,150,000 tons, and the rest of the Free World consumption at 640,000 tons, Raymond B. Ladoo, consulting engineer, observed that the estimated total Free World consumption in 1975 would be 1,790,000 short tons, of which 1,140,000 tons would be from natural fluorspar and 650,000 tons would be fluorspar equivalent from phosphate rock. "World production," he said, "in 1956 and 1957 averaged over 1.78-million tons. Thus we have already reached in world production the Paley Free World projected consumption for 1975 and fluorine recovery from phosphate rock is still insignificant. The inevitable conclusions are: (1) that the search for new reserves outside this country must be intensified, (2) that capacities of foreign plants must be increased and new plant built, and (3) rapid progress must be made in increasing fluorine recovery from phosphate rock. If we are not successful in these endeavors, consumption cannot increase at the projected rate."

Although the Paley Report envisioned no "phenomenal growth" in demand for barite, Ladoo said that sales by domestic producers increased

HAROLD EWOLDT, of Cerro de Pasco Corp., reflects convention's congeniality.

2½ times from the 1947-51 average of about 600,000 tons to 1956 sales of over 1.5-million tons. This, he said, would indicate "phenomenal growth."

Walter L. Rice, president of Reynolds Mining Corp., said that the Paley commission did an excellent job in forecasting growth and problems of the light metals industries, but that forecasts of growth were too conservative. "For example," he said, "they forecast 1975 United States aluminum consumption at about 4.5-million tons annually. We at Reynolds have made a careful study of our own, forecasting the expected growth of more than 20 major United States industries. We studied the potential for aluminum in more than 80 major applications. Our study indicates that if the United States economy doubles between now and 1975, as is generally expected, U.S. aluminum consumption can show a five-fold increase from the current usage of 2-million tons to a 1975 annual usage approaching 10-million tons."

"Unknown Powers"

One of the most inspiring talks of the convention was given by Henry J. Kaiser, Jr., vice president of Kaiser Industries Corp., who stressed the importance of unleashing the "unknown powers and capacities" that lie within individuals to achieve the so-called "miracles" of modern industry. "The Kaiser companies," he said, "are not built on miracle men—but on ordinary men, who have been given the encouragement and freedom to develop their unknown capacities to the fullest. We have tried to hold before such men, a vision of accomplishment—and a joy of achievement. And we have based this upon a philosophy of service. We're in business to fill human needs. We're in business to help the economy grow—and, in turn, to grow with the economy. These are the dynamics on which we have built our companies—and on which we move to the future. Every fellow on our team shares in this growth—and knows that he shares in it."

Shortcomings of Mineral Curricula

Future progress in mineral beneficiation will depend upon the quality of education and capacity for research possessed by our colleges—this was the conclusion drawn by Norman Weiss, milling engineer, American Smelting and Refining Co.,

MR. AND MRS. HOWARD PYLE share a happy moment. Mr. Pyle, of the Petroleum Society, is new AIME president.

LIKEWISE, for Jack Howe, Western Machinery Co., Dr. Glenn Seaborg, University of California, and Donald H. McLaughlin.

who spoke on the "Problems and Developments in Mineral Beneficiation." After reviewing recent advances in milling including automatic controls, hydrogen reduction and quality control, Weiss summarized shortcomings of the minerals beneficiation curricula as expressed by thoughtful observers. These were: (1) The field has become too narrow and too sterile to attract students. (2) Too much emphasis has been placed on physical and mechanical skills and techniques, current art and practice, and such immediately useful professional subjects as assaying, drafting and shop. (3) Emphasis on basic sciences and humanities is lacking. (4) Research needs more emphasis at the undergraduate level. (5) Schools have scarcely begun to develop high quality graduate work and research in beneficiation engineering. (6) Inspired students are lured away from colleges by higher paying jobs in industry and government. (7) High-priced equipment required for advanced study is beyond the finances of many colleges. (8) Some good students cannot afford to go on to graduate school.

AIME's New President

Howard C. Pyle, president of Monterey Oil Co., Los Angeles, was installed as the new president of the AIME on Feb. 17. Mr. Pyle received his Bachelor of Science degree in Petroleum Engineering and Geology from the University of California in 1926, and his Master of Science and Professional Engineering degree from the University of Southern California in 1939 and 1941, respectively. He has been chief production engineer for Union Oil Co.; president of Continental Consolidated Corp., and vice president of the Bank of America.

M. G. HANSEN, consulting engineer, visits with A. H. Shoemaker of Homestake Mining.

Dr. Joseph L. Gillson, chief geologist, E. I. du Pont de Nemours & Co., was designated as president-elect of the AIME.

Progress in Geophysics

Roger Pemberton, geophysicist of Canadian Aero Service, Toronto, said that the electromagnetic system developed by Newmont Mining Co., and flown by helicopter by Canadian Aero Service, measures the electrical properties in massive sulphide exploration with an accuracy heretofore seldom, if ever, achieved. Because of the nature of electromagnetic components being measured, Pemberton said that it is now possible to discriminate on a conductivity basis between different conductors. Massive sulphide deposits which had gone undetected in previous surveys by other methods were picked up by the new method in some areas of Canada.

Reporting on seismic investigations in ore prospecting, J. C. Stam, geophysicist, Hunting Technological and Exploration Service, suggested that "the seismic method should not be overlooked and consideration should be given in each problem if and how this method can be made useful to its solution."

Discussing long-hole drilling exploration, C. W. DeLaMare, general superintendent of mines, United Park City Mines Co., said that in general, conventional development work costs about 16 times as much as long-hole drilling. He said, "It has been estimated by our geologists that two-thirds of the ore discovered in the past two years has been found by the use of long-hole drilling at a direct cost of $108,000, compared to the direct cost of $483,500 spent on conventional development work during the same period, and which was credited with one-third of the ore discovered."

Elbow Room Speeds Output

Although Reserve Mining Co.'s operations at Silver Bay had been designed originally to produce 3,750,000 tons of iron ore pellets per year, Robert J. Linney, executive vice president of the company said that good basic engineering and plant design had enabled production to increase to about 5-million tons of pellets per year within a three-year initial operating period. "One big advantage to the operators," he said, "was the

DALE I. HAYES, vice president, Hidden Splendor Mining Co., greets E. R. Borcherdt, research engineer, The Anaconda Co.

EWALD KIPP, special representative, Eimco Corp., chats with A. E. Millar, general manager of Anaconda's Yerington mine.

SERIOUS DISCUSSION by E. C. Weichel, Jr. and Jay P. Wood of Humphrey's Gold Corp., and D. N. Vedensky, vice president, Hanna Mining Co.

COPPER MEN, Frank Day, Anaconda, and C. R. Kuzell, Phelps-Dodge, exchange greetings.

'elbow room' the designers allowed. They didn't cram the machinery in with a shoe horn. The planned extra space for unanticipated situations has paid off handsomely in the three short years of operation. To have provided 'tight' design would have been a great handicap."

"Good, dependable communication is one of the key factors" enabling the San Manuel mine to produce approximately 11-million tons of copper ore per year under high-speed, efficient, safe mining conditions, according to Charles L. Pillar, mine superintendent of Magma Copper Co.'s San Manuel operations. Cost of installing new communication equipment for the expanding development of the mine and maintaining all communication systems over the entire mine during 1958 was about $0.01 per ton produced. "It is now possible," he said, "by expansion and modification of a basic electronic communication system, to operate and protect completely, by remote automatic control, pumping, ventilation, ore transportation, ore dumping, ore loading and hoisting equipment."

From Gaspe to Chuqui

Mining and metallurgical technologists from Europe, Latin America and Canada contributed numerous important papers at the convention. W. G. Brissenden, manager of the Noranda Mines, Ltd. subsidiary, Gaspe Copper Mines, Ltd., said that Gaspe Copper produced about 2,250,000 tons of ore in 1958, more than 85% of which came from underground sources. The mine is now producing 8,000 tons of ore per day, six days a week, and the mill operates at a rated capacity of 6,500 tons per day. The smelter treats Gaspe concentrates plus some custom concentrates at the rate of 3,700 to 4,000 tons of copper anodes per month.

The Chuquicamata deposit of Chile Exploration Co. is one of the most valuable copper ore concentrations known, according to Robert Laurich, general mine foreman of the operation. The deposit extends 10,086 ft, reaches a width of 3,772 ft and has a depth of 1,086 ft, he said. Since the pit has been opened in 1915, some 700-million tons of material have been moved, including 472-million tons of ore and 228-million tons of waste. Laurich said that plans are being made for deep mining.

In a paper prepared by A. H. Kunkel, Jr., process metallurgist Singmaster & Breyer, and Gligorije Stankovic, superintendent of Yugoslavia's Hemiska Industrija Zorka electrolytic zinc plant, it was reported that the plant, 50 miles west of Belgrade, was designed to produce 12,000 metric tons of zinc per year,

(*Continued on p 118*)

Organic Matter in Ores and Tailings

JOHN ALLINGHAM

ORGANIC MATTER is present in many ores, rocks and especially in oxidized ores and old tailing dumps. Organic matter is always present in tailings resulting from the Patio Process and Pan Amalgamation Process. Organic matter may cause trouble in the hydrometallurgical treatment of such ores and tailings.

In the cyanidation of ores, organic matter may increase cyanide consumption, lower the dissolving power of the solution, increase the time of treatment and precipitate gold and silver dissolved in the pulp during treatment, settlement of pulp or during filtration.

One of the most common forms of organic matter is graphite, associated with certain ores of the mother lode gold in California. In the past it has caused difficulty in the cyanidation of such ores. Graphite will precipitate dissolved gold during cyanidation. The precipitating action of graphite and other forms of carbon can be prevented by a preliminary treatment of the ground ore with a chemical oxidant.

A graphitic concentrate from a mine on the mother lode was tested in the laboratory. The concentrate, without further regrinding, was first given a preliminary treatment with a solution of commercial permanganate at the rate of 20 lb of permanganate per ton of concentrate with a dilution of three of solution to one of concentrate. After the pulp had been agitated for 10 minutes, cyanide was added to the pulp to bring the solution to a strength of 2 lb per ton of solution, and caustic lime added at the rate of 0.5 lb per ton. The pulp was then agitated for six hours and filtered. The filter cake was washed with water.

From assays made on the dried cake and checked by assays of the total filtered solution, 94.6% of the gold had been dissolved by this method of treatment—showing that the precipitating property of this class of graphite is destroyed by oxidation. The tests on this concentrate were made many years ago and today there are much cheaper methods of oxidation than permanganate.

A concentrate assayed 2.2 oz gold per ton. A portion of the concentrate was panned to separate the graphite as free as possible from the iron pyrites. The separations were dried and weighed. The graphite separated represented 55% of the concentrate and, by assays made, contained 63% of the total gold in the concentrate. Direct cyanidation of the concentrate by agitation for six hours resulted in an extraction of 8% of the gold in a solution containing 2 lb of sodium cyanide per ton and a protective alkalinity of 0.12 lb per ton. The dilution was three of solution to one of concentrate.

In the laboratory, testing of the concentrate showed that the addition of sodium silicate to the cyanide solution inhibited to a marked degree the precipitating effect of the graphite. Commercial sodium silicate added at the rate of 15 lb per ton of concentrate showed an extraction of 57.2% of the gold, after eight hours treatment with the cyanide solution. Not all graphite in gold or silver-gold ores carries so much of the total gold as in the concentrate tested. The separated graphite concentrate selectively floated from the ore of the Monte Cristo mine, near Lone Pine, California, was of so low a grade that it did not pay to ship it to the smelter.

Silver ores containing manganese oxides, mined in various districts in Mexico, contain organic matter. Decayed vegetable matter was found in the ore from the Santa Cruz mine, Guanacevi, Mexico at a depth of 100 ft from the surface. The presence of organic matter in these ores can be confirmed by known chemical tests.

For many years Chas. Butters & Co. cyanided the dump of the tailing in Six Mile Canyon, near Virginia City, Nevada. This tailing contained organic and some sewerage matter. Laboratory tests proved that it was necessary to oxidize the tailing before treatment in order to obtain even fair extractions of the silver. Oxidation was accomplished by repeatedly plowing large areas several days before collecting and moving the tailings by wheel scrapers to the bins.

For some time and previous to being sent to the plant, the tailing had been reground in pebble mills and then pumped to the cyanide plant. After a year, the mills were shut down and the tailing was conveyed by belt from the bins to a pulping tank, with the overflow passing direct to the pumps.

Covering the opening at the top of the pulping tank was a 10-mesh screen, so arranged in a screen frame so that it could easily be replaced for cleaning. The floating pieces of wood, leaves, charcoal and other material were constantly skimmed off the surface and periodically the tank had to be cleaned. As the skimming operation and removal of floating matter required much attention, a trommel was put in equipped with a 10-mesh screen and the pulp from the tank flowed through this trommel. The oversize from the trommel was caught in wheelbarrows.

The oversize wood, organic matter, charcoal coarse and fine amounted to several wheelbarrows per shift. Tests showed that when the tailing had been fully oxidized, a high recovery of both silver and gold could be obtained by cyanidation. The maximum time of oxidation by plowing was six days, sometimes eight days, but since the mill was treating 400 tpd the area of the dump was not sufficient to allow the time necessary for oxidation.

In Guanajuato, Mexico, at the Santa Teresa Ranch, the original dump of tailing, resulting from the Patio Process, contained organic matter. This dump may have been contaminated by sewerage matter to some extent, but most of the organic matter was the result of decayed vegetable matter.

The first two feet in depth had been mixed with tailing from the modern mills at Guanajuato, which was brought down the river and overflowed on the old tailing.

Underlying this tailing were three other classes of tailing, one with a greenish and chocolate color, the next black in color with bluish spots and the last, colored black.

It was found necessary by tests to thoroughly oxidize the tailing before treatment to obtain good extractions either with cyanide or thiosulphate solutions. Tests were made by adding to a given weight of each tailing mixed with water, a measured amount of acidulated permanganate solution until a permanent pink color was obtained. This test indicated the amount of organic matter present, especially if no ferrous salts were present. The permanganate required was calculated in kilos per metric ton of tailing.

The results of the tests were:

Tailing	Permanganate required per metric ton (kilos)
Surface samples, semi-oxidized	3.80
Greenish and chocolate-colored	11.4
Black with bluish spots	19.0
Black	30.4

Mr. Allingham, retired metallurgist, Fontana, Calif., has been a frequent contributor to *E&MJ* and the old *Mining & Scientific Press*.

The dump contained about 400,000 tons of semi-oxidized tailing. This estimate included the surface tailing, the greenish and chocolate-colored tailing and the bluish-colored tailing. It was estimated that there were some 200,000 tons of black tailing. Tests showed that in order to obtain good extractions of the gold, silver and mercury contained in the tailing, either by treatment with cyanide or hyposulphite solutions, it was essential to oxidize the tailing, by plowing and turning over, before treatment.

A sample of a mixture of the semi-oxidized, greenish and chocolate-colored and bluish-colored tailing was oxidized by air and sunlight for three weeks, constantly being turned over.

A head sample for assay was obtained in the usual manner by mixing, coning and quartering. The assay results were:

	Ounces per ton
Silver	3.6
Gold	0.11
Mercury	30.00

The sample was then given a preliminary treatment by agitation with water and air, for 12 hours to further oxidize the tailing. The pulp was settled and the thickened pulp was treated with hyposulphite solution, sodium hyposulphite being added at the rate of three kilos per ton of solution.

After agitation of the pulp for 24 hours, the pulp was filtered and the cake washed. From assays of the residue, the extractions of the metals were calculated:

	Percent extracted
Silver	85.1
Gold	99.0
Mercury	84.2

The black slime treated with cyanide or hyposulphite solutions and without previous oxidation gave no extraction of these metals. The solutions showed some dissolution of copper and mercury. Many tests were made on the various classes of tailing in the laboratory and on a pilot plant scale by treatment with sulphurous acid followed by agitation of the pulp with sodium thiosulphate (hypo). Sulphur dioxide and air were forced slowly through the mechanically agitated pulp for two to four hours. Sodium thiosulphate was then added to the charge at the rate of three to four kilos per ton of tailing and agitation continued for 24 hours. The pulp was filtered and the cake washed. Assays of the solutions and washed cakes were made and the extractions calculated.

The percentage extractions were checked with the head assays of the various charges treated. It was found necessary, in the treatment of the black slime without previous oxidation on the dump, to aerate the slime during the sulphurous acid treatment. The extractions varied according to the degree of oxidation of the tailing.

The extractions obtained in the treatment of the black slime varied from 50 to 78% of the silver and 85 to 90% of the gold.

Extractions on the other classes of tailing varied from 75 to 85% of the silver and from 60 to 90% of the gold. The extraction of the mercury was high in all classes of tailing by the treatment given, from 80 to 90%. The amount of sulphur dioxide used in the tests was approximately 20 lb per ton of tailing.

A small quantity of black tailing agitated with a cyanide solution containing 20 oz of silver per ton, precipitated the total silver in five minutes. Many tests were made to prove that the black tailing acted as a precipitate of dissolved silver. From these results it was thought that the black color was due to ferrous sulphide, as ferrous sulphide in fine condition will precipitate silver and mercury from cyanide solutions.

A sample of the black tailing was roasted at about 500 deg C, while tailing showed a light red color. Any iron sulphides would have been completely oxidized. This roasted tailing was agitated with cyanide solution of a strength of 4 lb per ton of solution for 16 hours.

Assay of the filtered and washed residue was:

	Ounce per ton	Percent extraction
Silver	2.80	24.0
Gold	0.01	90.0

Roasting the tailing gave a high extraction of the gold, but the low extraction of the silver is difficult to understand. The black tailing was mixed with 10% caustic soda solution and heated for two hours at nearly boiling temperature. The color of the tailing after this treatment was brown. The pulp was filtered and the filtrate was a light brown in color. To a portion of the filtrate just enough hydrochloric was added to make the solution slightly acid. A light brown precipitate was formed, which is characteristic of humus treated with caustic soda solutions.

A black precipitate is formed when a small quantity of silver nitrate solution is added to the caustic soda solution. The silver contained in this black precipitate is soluble in cyanide solution to the extent of 45 to 50%. This black precipitate can be made soluble in either cyanide or thiosulphate solutions by a preliminary treatment with—

a. Any chemical oxidant, such as potassium permanganate, potassium bichromate, or bromine.
b. Hydrochloric acid and water with a little bichromate.
c. Sulphurous acid.

Iron sulphate added to the solution resulting from the caustic soda treatment of the black tailing, gives a black precipitate. This black iron precipitate when added to cyanide solution containing silver will precipitate the silver. When either pine oil, pine tar, rosin or rosin oil is boiled with caustic soda and water and silver nitrate is added to the sodium resinate solutions, the same black organic silver precipitate is formed. This silver precipitate is partly soluble in cyanide solutions. The sodium resinate solution will slowly change silver chloride to a black organic silver salt.

Ordinary humus, sold as fertilizer, when treated hot with caustic soda solution, gives a dark brown solution. This solution with silver nitrate gives a brown precipitate which slowly turns black. The silver contained in this black precipitate is partly soluble in cyanide solutions, and completely soluble in a strong caustic soda extraction of humus. On diluting caustic humus solution with water, the black silver salt precipitates. The caustic soda extraction from the treatment of humus gives a black insoluble precipitate with ferrous sulphate solution. The caustic soda solutions from the treatment of humus and the black tailing in the Guanajuato tailing dump were identical in chemical properties.

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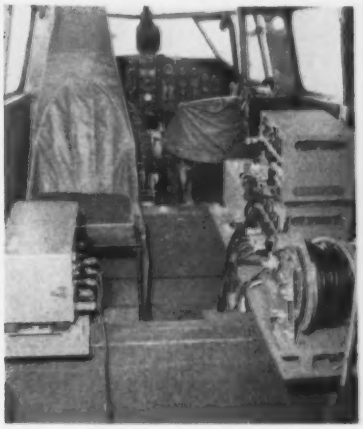


REAR PLANE transmits circularly polarized electromagnetic field which is received and recorded by apparatus in lead plane.

Two Planes Speed Aerial EM Work

USING TWO AIRPLANES for rotary-field electromagnetic prospecting rather than single plane schemes gives better results for lower costs in a shorter time, according to AB Elektrisk Malmletning of Sweden. The company reports that it has developed and proved the reconnaissance system for conductive minerals during more than two years of work in Scandinavia.

The two planes are flown in tandem about 300 ft above the ground and separated by between 400 to 1,000 ft. The lead plane carries the automatic recording apparatus, the receiver amplifier, a navigator-instrument observer, and tows the receiver coils on a 100-ft cable in a streamlined bird. The second plane flies at the same altitude as the bird and carries the transmitter coils. Two spotlights under the fuselage of the leading plane help the pilot in the second plane to keep his predetermined distance; the distance is selected to suit the particular survey requirements, but the holding of the correct distance between the two planes is not critical to the quality of the anomaly record.

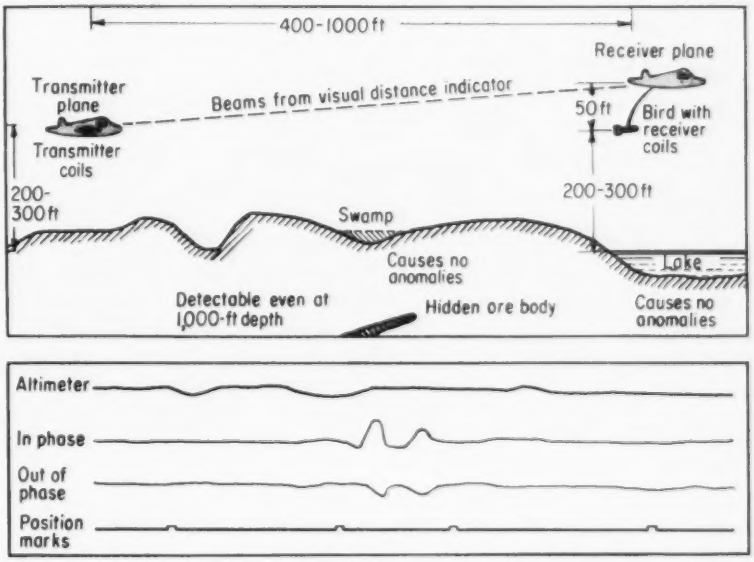
Advantages of the two-plane rotary-field system are stated as follows:

1. Higher flying speeds and operation in more turbulent conditions than other methods are possible because short towing cable cuts motion of bird;
2. Depth of penetration can be controlled by varying separation of planes or altitudes of flight;
3. Deeper penetration is achieved than by any other known electromagnetic method, thus assuring complete investigation of low parts of undulating terrain;
4. Distinct anomalies are recorded even when the orebody is covered by thick overburden;
5. No disturbances caused by lakes, rivers, bogs and the like, appear on the record.

The rotary-field system in itself is said to have an advantage—in that orientation and spacing of the transmitter relative to the receiver is not critical. In the system, two rotating transmitter coils are mounted at right angles to each other and produce a circularly polarized electromagnetic field. When this field embraces conductors in the earth, secondary fields are produced. The resultant field is detected by the receiver coils and a record is obtained of the deviations from normal of the amplitude of in-phase and out-of-phase components of this field. These deviations indicate the presence of the conductors and show up on the record. See below.

Results are plotted on a map and correlated with all known geographic features. From the interpretation of the anomaly curves areas can be selected for detailed measurements while barren areas can be excluded.

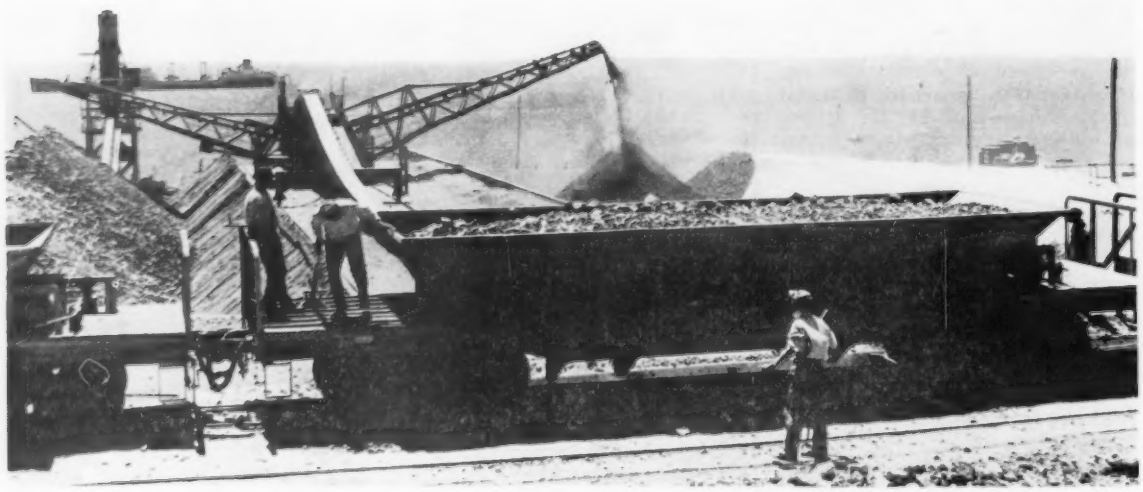
The higher speed of the survey, the fewer days wasted in waiting for suitable weather, and the consistent quality of recordings frequently make it possible to carry out a two-plane survey at lower cost than an equivalent survey by only one plane and at a small fraction of the cost of a helicopter survey.



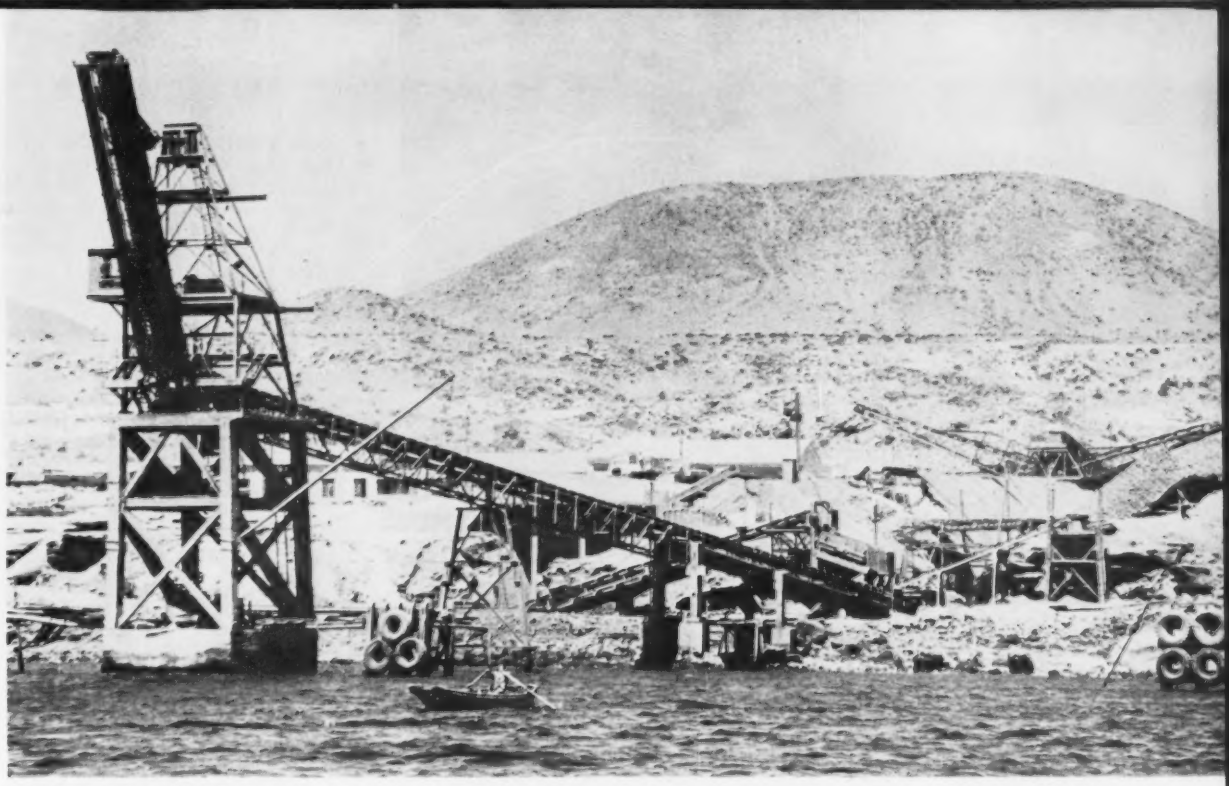
NEW PLANNING and engineering concepts that went into Cia. Minera Santa Barbara's expanded iron ore loading facilities near Huasco, Chile, called for: (1) starting to load ships with a minimum initial investment; (2) loading as soon as possible to get increased production and savings; and (3) providing for gradual expansion without interruption of service.

Chilean Mine Continuously Ships Iron

PAUL SOROS



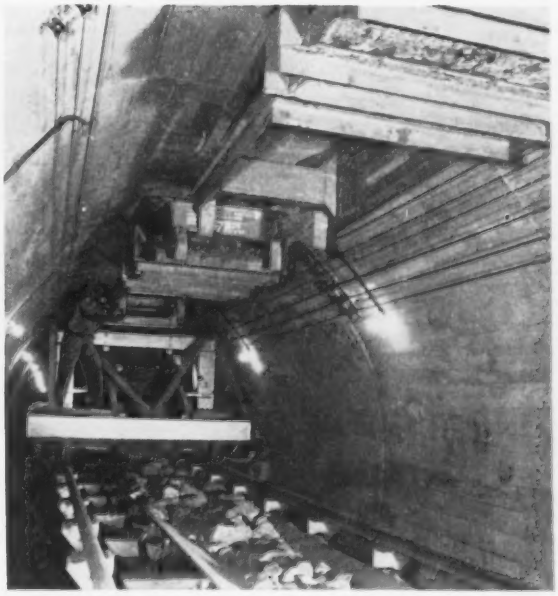
1 TRAINS of twelve 34-ton bottom hopper cars empty ore into two shaking feeders. The material is then conveyed via a double arm stacker to either of the two storage piles. Company's lumpy, open-hearth-type ore (66% Fe) is mined in open pits located 40 miles from the port. It undergoes no crushing or sizing and is trucked to the railroad.



PLAN WAS CARRIED OUT by: (1) storing 22,000 tons of ore at the port to accommodate 25,000 ton monthly production; (2) improving harbor facilities to handle 26,000 ton ore carriers; (3) increasing live storage to allow for 60,000 tons maximum monthly production; and (4) increasing loading capacity and stockpiling and loading fines separately.

Ore During Port Expansion Program

2 **FIRST STORAGE BIN** held 22,000 tons. Plans called for a larger second bin (38,000 tons)—first stacker, therefore, had part of second arm as counterweight.

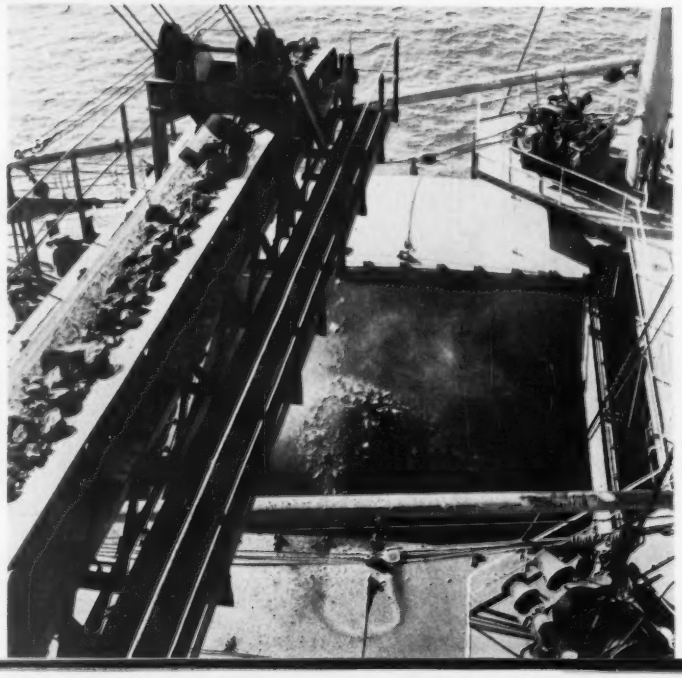


3 **TUNNEL CONVEYOR** under each ore pile is fed by a traveling shaking feeder (same as under railroad hopper) which automatically operates cut-off gates spaced 20 ft apart.

4 ORE EMERGES from sub-bin tunnel and heads for the pier conveyor. All conveyors are 36-in. wide, with 600 tph capacity. To save costs, all construction work, including a floating caisson-type foundation for the loading tower, was done locally. Equipment was purchased in the U.S. from Hewitt-Robins, Inc., who also designed the conveyor system. Cia. Minera Santa Barbara is a Chilean-owned firm with some foreign stockholders. Officers include: Emerico Letay, president; José Klein, vice president in charge of operations; W. J. Cook, mine manager; Von Bennevitz, port manager.

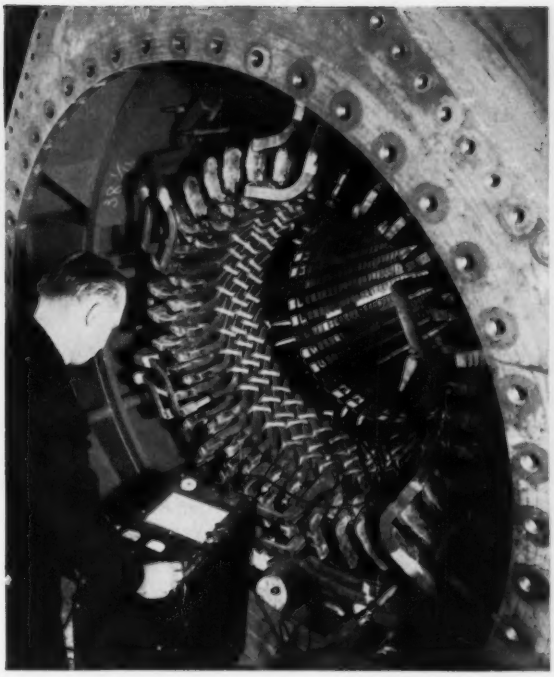
Ships Move—Loading Tower Is Stationary

5 PIER CONVEYOR includes a hinged boom section. Costs and ore breakage were reduced by eliminating a separate boom conveyor. The costs of a deep water pier, to support the customary traveling ship loading tower, would have made the whole project uneconomical. Instead, the loading tower was kept stationary and the ships were moved back and forth. This was done by the ship's anchor and mooring lines to six buoys and two points on land.

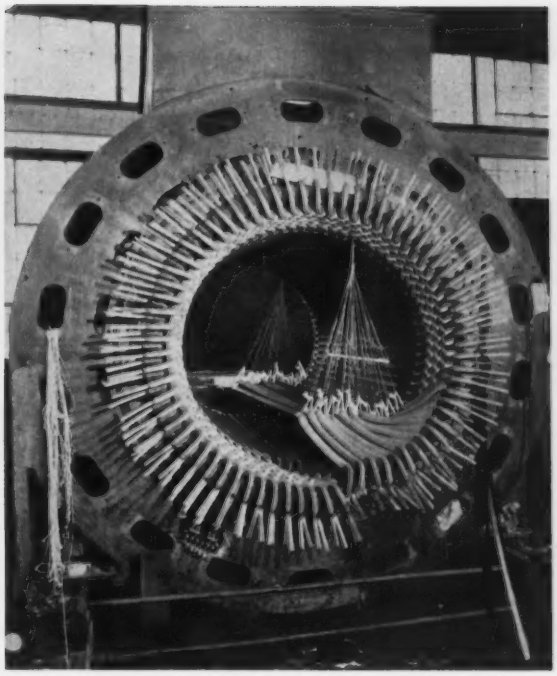


6 OPERATING RESULTS gave a 75% efficiency in terms of rated conveyor capacity. A T-2 type 18,000-ton ore carrier with eight holds was loaded in 35 to 40 hours, requiring seven ship movements. The experience at Port Santa Barbara seems to indicate that, depending on yearly capacity, worthwhile savings can be made by eliminating the pier. In addition, building a bulk port in several steps, rather than completely in one operation, can result in earlier operating dates, or lower minimum investments, or both.

Mr. Soros is a bulk port consultant, New Canaan, Conn.



VISUAL inspection of the windings does not give the whole answer. DC overpotential testing is a valuable shop aid.



MOTOR failure can lead to lost income. A large crushing motor outage may mean $60- to $75,000 a day production loss.

How To Maintain Your Electric Motors

M. J. WOHLGEMUTH

ROTATING ELECTRICAL EQUIPMENT, such as a motor, if applied properly and operated properly will last longer and require less maintenance if it is kept clean and adequately lubricated. Here's what is recommended to get the most out of your electric motors.

The maintenance department in a plant must assume, after an installation of a drive has been completed and turned over to the operating department, that the equipment has been applied properly. The maintenance engineer, therefore, would not question the horsepower rating of the motor, the type of the motor, or the operating characteristics until trouble develops which cannot be attributed to any other cause than misapplication. Fortunately, such cases are rather rare, but the maintenance engineer should be able to recognize the problem and make recommendations for correction.

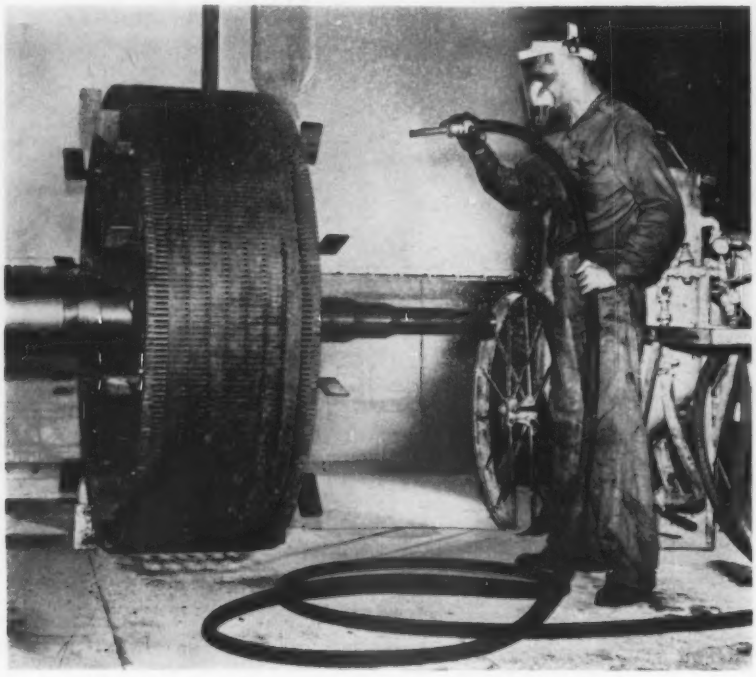
A good example is that involving local atmospheric conditions. An open motor has been supplied for a drive where the surrounding conditions are extremely dirty or where considerable water is splashed around the motor. Also, some equipment is located in mills and refineries where the atmosphere around the equipment may contain injurious elements. In some of these applications, a splash-proof motor is needed; in others a totally enclosed motor is necessary. In some instances where ambient temperatures are high, a separately ventilated motor with air from outside may be necessary.

With a large number of drives being purchased with the machine, there may be cases where not all of the facts surrounding the installation are passed on to the machine builder. He does the best he can in supplying the drive. There are some cases, of course, where conditions may change some time after the installation is made which may make the drive inadequate.

When a motor winding burns out, it may be because the motor is overloaded to such an extent that the rating of the motor can be questioned. In some cases, the maintenance engineer may be fortunate in that the overloaded condition may be detected before a failure occurs. Overheating of the motor or tripping of protective relays is generally a flag that the machine may be overloaded, assuming, of course, that other factors, such as proper voltage, are satisfactory. Graphic charts taken on such a drive over a period of time should give the complete story. If you are fortunate to get there before a failure, the operating department can be advised to cut back production until such time as a new drive can be installed or, if a large motor is available, replacement can be made properly. Fortunately, such occasions are rather rare, but the maintenance department must be prepared to act.

Some plants, such as steel, paper, metal and mineral processing and the like, operate on practically a continuous basis which makes maintenance exceedingly difficult. However, in almost all cases, individual departments of such plants have some downtime for mechanical work such as felt or wire changes on paper machines, relining of furnaces, etc., so that a close tie-in with the operating departments can establish a maintenance plan to everyone's satisfaction. Also, in a number of continuous production plants, such as steel, there is usually

Mr. Wohlgemuth is assistant to the manager, service department, apparatus division, Westinghouse Electric Co., East Pittsburgh, Pa. His paper was presented at the 9th Plant Maintenance & Engineering Conference, held concurrently with the 9th Plant Maintenance & Engineering Show, Chicago, Ill., January 1958. Copyright 1958 © by Clapp & Poliak, Inc., New York City.



CLEANLINESS cannot be overemphasized. A dirty motor will overheat, causing damage to the windings, and dirt may lead to motor failure due to current flashovers.

one shift per week set aside for mechanical and electrical maintenance, at which time scheduled work can be accomplished.

In general, however, no one schedule can be set down as universal. In each plant, the maintenance engineer should work out a plan with the operating departments for routine inspections and maintenance. For major maintenance or repair work, special setups must be made. In some plants where conditions are favorable, especially as to cleanliness, the routine inspection period can be extended. In general, important drives should be visually inspected monthly with a good general inspection once a year.

Keep the Motor Clean

Visual inspections are confined to determining where the equipment has accumulated any dirt and, if so, to blow out the dirt with dry compressed air using pressure not exceeding 50 psi. Cleanliness cannot be emphasized too highly. Dirt and dust, which can be abrasive, is detrimental to insulation and can clog ventilating ducts in the machine, causing excessive operating temperature. The operating temperature and, consequently, the life of organic insulating materials depends on the proper circulation of air for cooling by convection, together with conduction and heat radiation.

In many cases, dirt or dust combines with oil vapors which may be present, with carbon dust from brushes, with metallic particles, all of which can be conducting. Such materials provide leakage or conducting paths over the surfaces of insulation or through cracks in insulation and such leakage paths, unless removed, can eventually cause failures due to flashovers on grounds.

Check Insulation Resistance

Visual inspection of windings does not give the whole answer as to the state of cleanliness, as in many cases the offending dirt or deterioration of insulation may not be visible. An important supplement to visual inspection therefore is the measurement of the insulation resistance. One of the important things gained by an insulation resistance test is the detection of uncleanliness or deterioration which is not visible to the eye. Such a test also serves as a check on whether cleaning or reconditioning of a piece of equipment has been effective.

Relative value of insulation resistance is the most reliable measure of whether there are unwanted elements present in the windings. In order that successive readings of insulation resistance be of value, the conditions under which the readings are taken must be evaluated. Such items as temperature and humidity should be taken into account as insulation resistance varies with both. Also, leakage over terminals and other surfaces can give erroneous results and these must be taken into account when measurements are taken.

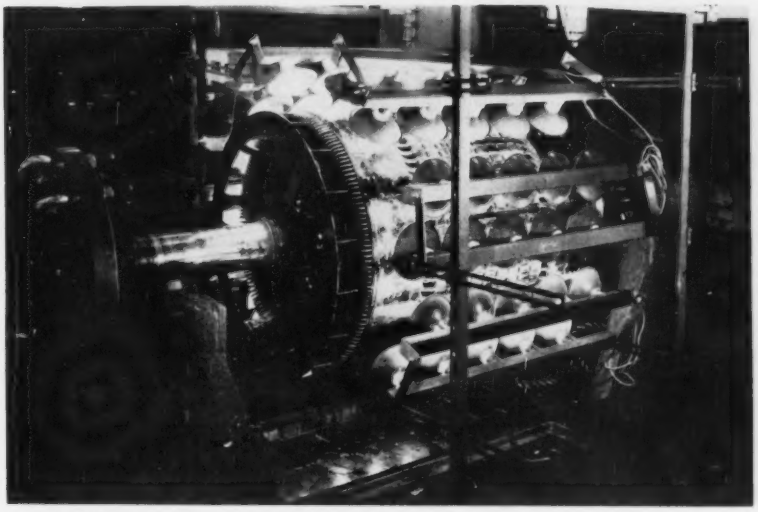
Duration of test voltage is important as a clean, dry winding responds differently to test voltage than a dirty, damp winding. For best results, it is recommended that a dielectric absorption test be made, especially on larger machines. This test consists of applying the test voltage for 10 minutes, reading insulation resistance at 1-minute intervals and plotting a resistance time curve. Clean, dry winding will increase in insulation resistance with time, but values for dirty, moist windings will taper off rapidly. Slope of the curve is an indication, therefore, of the condition of the winding. Ratio of the 10-minute value to the 1-minute value is called the Polarization Index or P. I.

Newer Types of Insulation

For clean, dry windings with Class A insulation the P. I. should be 1.5 or more and for Class B insulation 2.5 or more. These values are for the usual varnish or asphalt impregnated windings. However, the newer types of insulation may have different P. I. values, usually higher. It should be noted that, if tests are made with cable or bus connections attached, the resistance values may be considerably lower and may not reflect the true condition of the machine insulation.

The means for cleaning motor windings are many and are covered fully in publications such as *Maintenance Engineering Handbook*, published last year, various publications by manufacturers of motors, and numerous papers presented before various societies. Time, therefore, will not be taken here to detail cleaning techniques.

On large ac motors operating from higher voltages such as 2.3 kv and above, such as those used on hoists, compressors, pumps, mill drives, and the like, and on large dc motors, additional tests might be included. An over-potential test might be desirable as it gives assurance that a dielectric level is being maintained. Wide acceptance has been obtained of dc over-potential testing. Dc testing does not present the hazards that ac testing does as the capacity required even for the largest machines is very small. In consequence, if there is an insulation breakdown, the power that follows does not result in burning of the iron. The physical size of the dc tester is small and can be carried from department to department, and it can be operated from the 60-cycle lighting circuit. The recommended test voltage is 1.6 times the normal ac test voltage.



REWOUND rotors are dried with the aid of infrared lamps. Clean, dry winding will increase in insulation resistance when subjected to absorption tests as described.

On machines in service, the test voltage used is two-thirds to three-quarters that for a new machine.

Some larger pedestal type machines usually have one pedestal insulated to prevent bearing currents. On such machines, the condition of the insulation, which is usually a plate under the pedestal foot, should be cleaned to eliminate creepage paths and then checked with a 500-v megger. The insulating parts on the holding down bolts should be inspected, especially if the pedestal insulation resistance reading is low.

Care of current collecting devices such as slip rings and commutators has been fully covered in many publications and will not be dealt with in detail here. Suffice it to say that such devices should be kept in good condition as they can affect the proper operation of your motors.

Study Bearing Lubrication

In order to utilize electrical energy and obtain mechanical movement, rotation is necessary. This means that bearings of some type are essential. One of the vulnerable parts of a piece of rotating machinery is in the bearings.

Proper choice of bearing surface is that of the designer, who can choose between a sliding or sleeve bearing and a rolling or antifriction bearing (ball or roller). In order to operate efficiently and, as a matter of fact in order to operate at all, bearings must have some kind of lubrication.

An analysis over a considerable number of years of induction motor failures shows that bearings contributed to a large percentage. To a lesser extent, this can apply to other types of motors. Therefore, proper maintenance and lubrication of bearings is an important item. If a bearing fails, the rotor will rub on the stator and give you, usually, a major repair job.

Until recent years, the most generally used bearing was the sleeve type. Within the last 10 years or so, the trend has been to the "antifriction" type, either roller or ball, and for most applications this type has become a standard with all manufacturers. Sleeve bearings are still a "must," however, in certain specialized applications, particularly where large shaft diameters are involved and also for use in high speeds. Where a split bearing is required such as for large heavy rotors, the sleeve bearing is still used.

Pre-babbitt Properly

When repairing sleeve bearings by re-babbitting, be sure to use materials from a reliable supplier, obtaining babbitt as recommended by the manufacturer of the motor. Do not make any changes in the composition of the babbitt. Two general types of babbitt are in popular use. The tin base type contains 80 to 90% tin with the remainder divided about equally between copper and antimony. The lead base type contains about 75 to 85% lead with 5 to 10% tin and 10 to 5% antimony.

Either type is satisfactory for general purpose use but tin base babbitt is generally used in corrosive atmospheres. Reinstallation of a repaired bearing should be done carefully, checking clearances to be sure that the bearing will not heat because of too small clearance. Several rules are available for determining proper clearance. Some manufacturers indicate diametrical clearance of 0.002 in. per inch of diameter of shaft except for small bearings which will have larger clearance. Others use 0.001 in. diametrical clearance for shafts 1 in. dia or less, on larger shafts 0.001 in. plus 0.001 in. per inch of shaft diameter up to 0.006 in. However, a good rule for general use is the first one.

Antifriction Bearings

Since antifriction bearings operate on entirely different principles than do sleeve bearings, it is misleading to make comparisons of the two types or to diagnose the troubles of one type by experiences with the other type. The only true comparison is the service obtained over a period of time.

Antifriction bearing assembly is a self-contained unit made to very close limits and with a high degree of surface finish. Therefore, it must be handled carefully and dirt and corrosive conditions must be kept away. Motor bearing housings using antifriction bearings must, therefore, be designed to exclude entry of dirt as much as possible. Careful handling of the bearing during installation and protection from dirt during lubrication is extremely important to trouble-free operation.

In order to eliminate these hazards as much as possible, ball bearing manufacturers in conjunction with motor manufacturers developed pre-lubricated sealed bearings. Experiments with such types began many years ago and have progressed to the point where pre-lubricated bearings are almost universally accepted. In this country the bearing used is usually the standard double-row-bearing width with a single row of balls, leaving space for an efficient seal.

Bear in mind that the standard ball bearing and the pre-lubricated ones do not differ fundamentally. Both are made from the same material to the same specifications regarding tolerances and fits. The pre-lubricated bearing is rated to carry the same load and have the same life as its open counterpart. The textile industry gave the sealed bearing its impetus when bearing manufacturers were asked to develop a bearing to lick the tough problem of protecting grease fittings or oil cups from lint that settles in heavy layers on any surface wetted by oil. Success in the textile field rapidly spread the use of pre-lubricated bearings to practically all industries.

Maintenance of antifriction bearings includes lubrication, removal, cleaning and re-installation. These bearings, while requiring more care in handling than do sleeve bearings, do not need to be handled like fragile china. Since

Here's a Check List for Motor Maintenance

VISUAL INSPECTION OF MOTORS will take in the mechanical features of the machine. Some of these items could reasonably be considered as electrical since they are part of the electrical circuit, but, in order to function properly, they must be in good mechanical condition. The important parts to check are as follows:

AC Motors

1. Stator windings
- **(a) General appearance**
  - Coil finish condition
  - General cleanliness
- **(b) Coil condition in slots**
  - Condition of wedges
  - Check for wedge movement
  - Check for loose wedges
  - Check for evidence of coil looseness
- **(c) Coil condition in end winding**
  - Condition and tightness of blocks and spacers
  - Condition and tightness of cord lashing
  - Coil surface condition
  - Condition with respect to possible distortion
  - Compound migration
  - Insulation swelling
- **(d) Evidence of corona or slot discharge distress** (high voltage machine)
- **(e) Condition of core**
  - Tightness of laminations
  - Cleanliness of ventilating ducts
  - Heating of finger plates

2. Rotor windings
- **(a) Synchronous motors**
  - Evidence of movement or shifting of coils
  - Evidence of movement or looseness of poles
  - General cleanliness
  - Condition of ground insulation washers
  - Connections between coils and to collector
  - Condition of collector insulation
  - Mechanical looseness of parts
- **(b) Wound rotor motors**
  - Condition of wedges
  - Check wedge movement
  - Check for loose wedges
  - Check for coil looseness
  - Check end windage for distortion
  - Check end winding, blocking and lashing
  - Check rotor banding
- **(c) Squirrel cage motor**
  - Check for cracked rotor bars
  - Check end rings for connection to bars
- **(d) On all larger motors, air gap measurements should be taken periodically and recorded as an indication of bearing wear.**

DC Motors

1. Stator or field
- (a) General appearance
  - Field coil condition
  - General cleanliness
- (b) Coil tightness
- (c) Evidence of heating of connections of shunt fields
- (d) Evidence of heating of commutating and compensating winding connections
- (e) Tightness of current collecting ring and its connections
- (f) Check connections between the halves of the field frame
- (g) Brush rigging
  - Brushes free in the holders
  - Brush tension device operative, in good condition and set to give proper brush pressure
  - Brush shunts in good condition and the shunt terminals making good contact where bolted to the brushholders
  - Check for evidence of brush vibration or chatter
  - Replace any worn-out brushes

2. Armature
- (a) Commutator
  - Check surface condition for roughness, smutty appearance and poor color
  - Check for eccentricity with dial indicator
  - Check for improper bar edge bevelling, poor mica undercutting and burned bars
- (b) Check general armature condition, especially as to cleanliness
- (c) Check for loose wedges
- (d) Check armature banding
- (e) Check cross connection joints for tightness
- (f) Check journals and bearings for wear, high spots and check oil rings for concentricity and for flat spots.

3. General
- Check cable or bus connections to armature and field for tightness and signs of heating

they are precision made, this precision must be maintained during their useful life.

Certain precautions should be taken before installing a new bearing. First, be sure your hands are clean. Wash your hands, but not the bearing; it has been pre-greased by the manufacturer. Press it in place on the shaft, don't hammer it!

When inspecting an old bearing, look for hardened areas. Streaks or spots are an indication. Look for cracked balls or rollers, etching from possible contact with acid and discolored areas caused by overheating. Any of these defects should cause rejection.

Removal of a bearing should be done with a bearing puller which looks and works like a gear or pulley puller. Always apply the pulling force on the inner ring or race which is on the shaft. Never pull on the outer race.

Installation of a bearing usually calls for a press and a pipe sleeve. After the bearing is lined up, select a pipe sleeve with the same diameter as the inner race. The sleeve should be placed between the press and the inner race, even pressure applied and the bearing will slide in place. Some bearings are difficult to install. It may call for heating the bearing in hot oil in order to expand the inner race so that it will slide on the shaft. Heating to between approximately 95 and 120 deg C (200 to 250 deg F) will give a good shrink fit on the shaft. At times, it may be more convenient to use dry ice and shrink the shaft, and allow the bearing to slide in easily.

Lubrication of bearings is probably one of the controversial items in maintenance of motors. It has become so important that most plants or companies now have a lubrication engineer whose training is such that he can make recommendations and advise on all problems regarding lubrication not only of motors but on all equipment installed in the plants. It is not the intent of this discussion to delve into the whys and wherefores and ramifications of lubricating oils and greases. The plant lubricating engineer or representatives of oil companies should be used. A few essential points, however, should be noted.

The manufacturer of the equipment recommends the type of lubricant to be used with his product to obtain what he feels to be the best results. These recommendations should be followed unless conditions change.

Lubrication of sleeve bearings, in general, is accomplished by hand oiling or greasing depending on the type required. In some applications, where a large number of motors are involved in an area, centralized lubrication is used. This method is more efficient and less expensive than manual as it distributes the correct amount of lubricant at the proper time intervals. Most motor bearings of the sleeve variety where manual or individual lubrication is performed have oil rings

that carry lubricant from a reservoir onto the shaft. These rings should be checked at periodic intervals to determine whether they are rotating and thus are carrying lubricant to the journal and bearing. Needless to say, when lubricating, the oil added should be clean and the equipment used should be clean. Dust and dirt are enemies of bearings of all kinds.

An antifriction bearing properly installed and properly lubricated according to the manufacturer's recommendations will give you service you desire. But if you slip up by neglecting your lubrication periods, using the wrong lubricant or letting dirt get into the bearing, you let yourself in for trouble due to bearing failures. This type of bearing is more susceptible to failures from dirt and incorrect lubrication than is a sleeve bearing.

The main points to remember about bearings are the careful handling, proper removal and installation and lubrication with correct lubricant.

About Spares and Parts

In plants where there are a large number of motors and where some of the drives are vital to the operation, it is economical to carry spare units. On smaller motors, especially squirrel cages, complete motors can be carried because it is comparatively easy to change a motor in case of a failure and make repairs to the damaged unit when convenient.

On large main drives, such as dc motors or driving reversing mills, such practices become costly and the extent of replacement units has to be weighed very carefully against loss of production. It may be economical even on large motors of several thousand horsepower to carry a spare armature. A large crushing or grinding mill outage may mean a loss of $60,000 to $75,000 per day in production and a major trouble may take days or even weeks to repair. One of the large steel companies has a spare armature which can be used on reversing blooming mills in three different plants. The armature is kept on a special railroad car, ready to be moved to one of the locations in case of a breakdown.

This may be cited as the upper extremity in loss prevention but it has paid off several times and has more than justified the investment in the spare armature, special car, housing, etc. In between no spares and the ultra just mentioned lies the best solution for your plant as far as carrying spare units are concerned.

On larger ac motors, especially where higher voltages are used, a partial set of coils, say one-fourth or one-third, is commonly carried because in a large number of cases when failure occurs on such drives, a coil or a few coils can be replaced in a comparatively short time. Conditions from plant to plant vary so widely that it is extremely difficult to set down a format or rules on what and how many spares to carry. Agreement between the maintenance and operating departments can usually settle how far you should go.

Keep Accurate Records

One of the must items for intelligent and useful maintenance work is that of records. I know in this day and age reports and records plague all of us. However, in order to get the most out of a maintenance program, you must know where you started and where you are going. Records on motors are comparatively easy to compile and keep up to date. There are many different record forms available. A large variety of record forms are available to suit practically everyone's taste and system. Such companies as Cardex, Acme Visible Records, etc., make such forms. With the increasing use of automatic machines for records by larger companies, such systems as Remington Rand and IBM are available.

I would like to close with some excerpts on the subject of maintenance as outlined in very good fashion by J. D. Quinn of E. I. DuPont in a paper before the ASME semi-annual meeting, June 1957.

"The solution of maintenance problems is not a requirement that has developed recently, but, with the development of modern industry, the requirements have become much more demanding. The days of 'fire fighting' in maintenance are rapidly passing, but we cannot be complacent about preventive maintenance either. We may be performing work that better analysis would prove unnecessary.

"A logical approach leading to an optimum balance between excessive emergency maintenance and excessive preventive maintenance, includes:

1. A systematic means of procuring background data concerning equipment repairs, their cause and effects.
2. An organized plan for the solution of problems which includes assignment of personnel to the program, and periodic reporting of the program to establish justification and priority for studies.
3. Accumulation of sufficient data to evaluate improvements being considered and, later, to establish the effect of the improvements and the benefits of the over-all program.

"Through this approach, the justification of engineering time for problem solution can be established. Problem solution, or corrective maintenance, can be considered as a business proposition that shows an excellent return on the expenditure, and results in a significant contribution to the production of a quality product at a lower cost."

AEC Foreign Contracts Expire Dec. 31, 1966

THROUGH an error in the February 1959 issue of *Engineering & Mining Journal*, the date of expiration of contracts with South African mines on the part of the Combined Development Agency (British and U.S. AEC) was listed incorrectly. The South African contracts for uranium concentrate purchases expire Dec. 31, 1966, and represent the end of foreign commitments on the part of the U.S. AEC for foreign uranium ore and concentrate purchases.

In the period since publication, some other amplifications and exact totals have been announced in the U.S. and abroad. The table, on p 120, which contained estimates of concentrate production may now be revised as follows:

1) Revised figures for U.S. production in terms of uranium oxide in 1958 show actual output as 12,560 tons. *E&MJ* estimated 12,300.

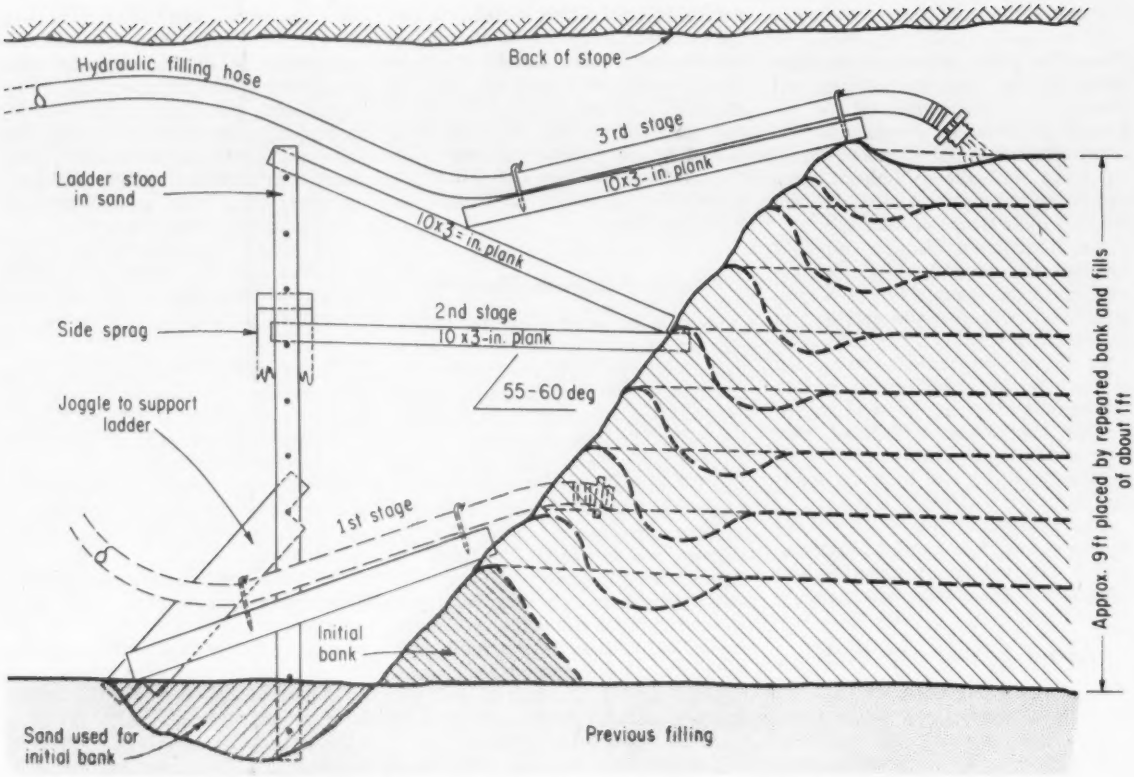
2) Actual Canadian shipments for the year, according to Ottawa, were 13,537 of contained oxide.

3) Prof. Felice Ippolito, of Comitato Nazionale per la Richerche Nucleari, Rome has suggested that the estimate of the grade of Italian ore listed in the table on p 120 might better be placed at 0.15%, and notes that the Spinetta Marengo uranium metal pilot plant is owned by Montecatini and the S. Donato Milanese by the firm of Somiren.

4) Uranium Reduction Co. of Moab is scheduling the installation of a $3-million alkaline leach circuit in the future.

The U.S. AEC has released production statistics for the second half of 1958 as follows—ore reserves, 82.5-million tons; ore receipts, 2,807,000 tons; ore milled, 3,011,000 tons; ore in stockpile at year end, 1,747,636 tons.

Concentrate received at Grand Junction contained 6,651 tons of oxide. In December, the U.S. had 23 mills producing 1,251 tons of contained oxide from 571,000 tons of ore—suggesting that in 1959 U.S. concentrate production will be in excess of 15,000 tons contained oxide from in excess of 6.7-million tons of ore mined and milled.



IN ONE-FOOT LAYERS, dam is built concurrently with filling. Slope of outside face is maintained at 55 to 60 deg.

Sand Dams for Hydraulic Fill

MINING COSTS HAVE BEEN CUT SHARPLY by forming retaining dams of the hydraulic-placed tailing itself in cut-and-fill stopes at Consolidated Zinc Pty. Ltd., Broken Hill, Australia.

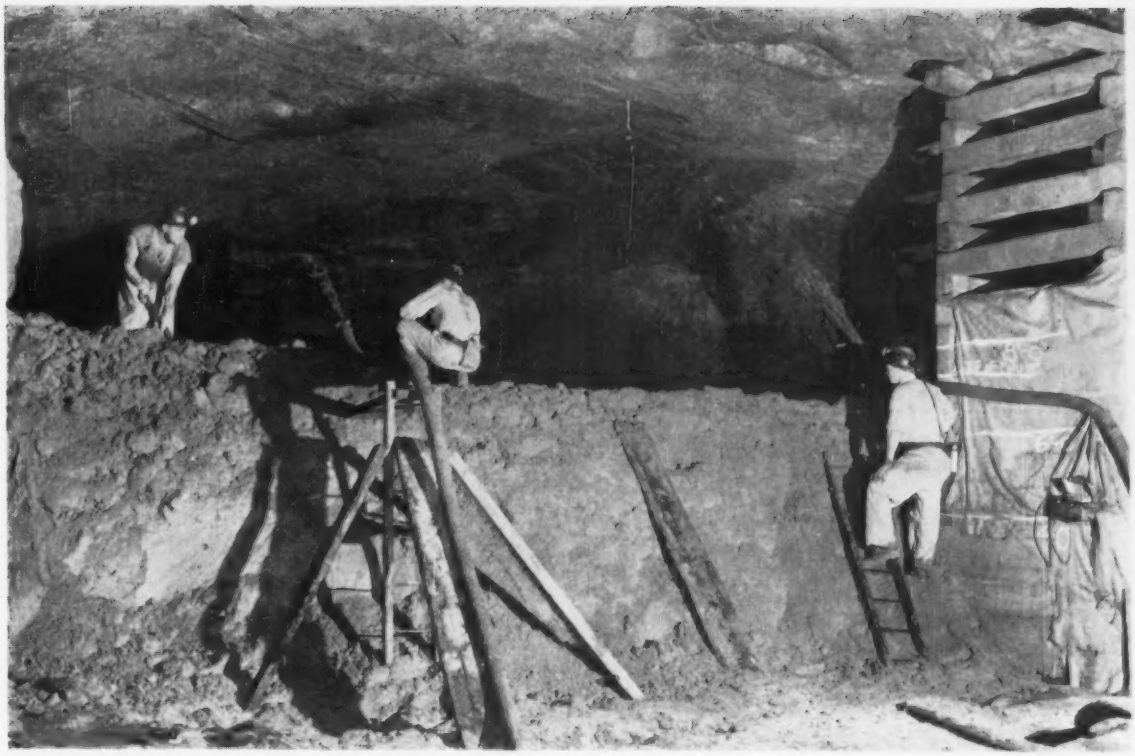
The new scheme was introduced recently when company engineers acted on the suggestion of a visiting Uganda mine superintendent, Mr. J. Taylor. So far, three trial dams have been built, with excellent results. Two were 8 ft high and one 9 ft.

The procedure (shown in the diagram and in the photos starting at lower left) begins by piling up a one to three-foot high level bank of sand across the stope at the edges of the area to be filled. Dry sand is used, dug from the previous filling just outside the area to be filled. At the same time, cribbed raises are extended up and

INITIAL BANK is made with old fill.

FILLING STARTS after raises are ready.

WET MATERIAL is used for buildup.



FILLS OF 8 AND 9 FEET have been successful. Excess water drains-off through burlap around cribbed raises inside dam.

Reduce Costs at Broken Hill

covered with burlap to the level the fill will reach. Then the outlet end of the heavy filling hose is fastened to a heavy timber resting on the dam and filling begins.

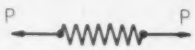
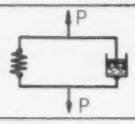
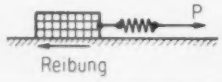
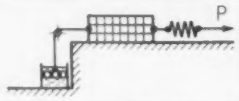
Sound-powered telephones keep stope in contact with fill-supply crew.

As the fill rises behind the dam, wet material is used to build up the dam in one-foot layers, maintaining the slope of the dry face at about 55 to 60 degrees. Periodically the filling hose is raised up on staging.

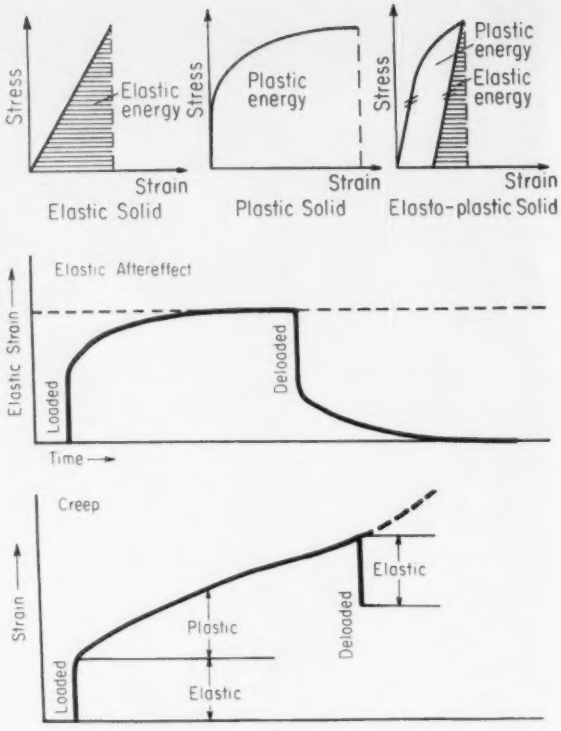
In the past, temporary barricades were made of timber covered with burlap or of a timber frame covered with wire netting and then burlap. Such barricades were expensive to build and, although they were recovered whenever possible, required considerable bracing.

NO WASHOUT results even if hose nozzle is close to dam.

THIN SLURRY spreads through far reaches of stope easily.

Deformation	Name	Mechanisches Modell
elastisch (elastic)	Hooke	
anelastisch (Nachwirkung) (inelastic)	Kelwin	
plastisch (plastic)	St. Venant	
viskoplastisch (visco-plastic)	Bingham	
Relaxierend	Maxwell	
zäh (viscous)	Newton	

MECHANICAL MODEL of rock body which most closely represents reality appears to be viscoplastic. (Salustowicz)



FRACTURE VIOLENCE is a function of elastic energy released. It is greater in highly elastic quartz than in an elasto-plastic material. Creep may delay failure. (Denkhaus)

Ground Control Discussed at Leipzig

SOME ACQUAINTANCE with the considerable foreign research on ground control was afforded by an International Rock Pressure Conference held in Leipzig, East Germany, on October 14 to 16, 1958. Main bulk of the 260 participants came from Soviet-bloc countries, particularly from Russia and Czechoslovakia.

Twenty-one papers were presented at five sessions. The complete texts have been published by Erschienen im Akademie-Verlag Gmbh, Mohrenstrasse 39, Berlin W8. The illustrations used in this article have been reproduced from that publication.

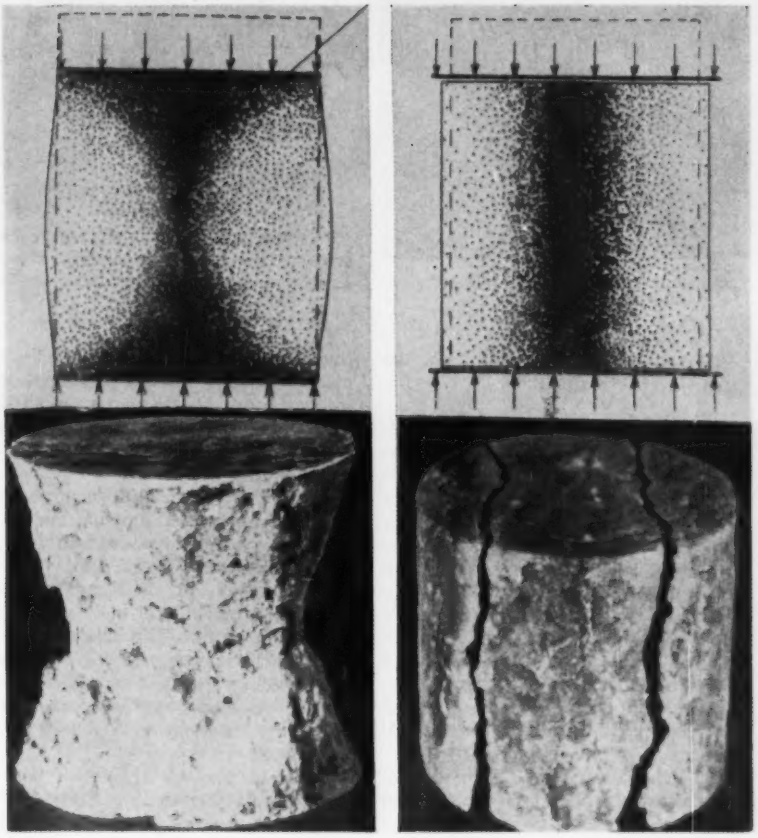
Organization of the meeting was under the leadership of Prof. Bilkenroth, of Berlin, who opened the conference and welcomed visitors from both sides of the 'Iron Curtain'. With the common consent of all participating members, the German Academy of Sciences, in Berlin, was asked to organize the time and place of the next conference scheduled for 1961.

A. Salustowicz (Cracow, Poland) pointed out that since field and laboratory data show that the phenomena of rock pressure depend on time, the appropriate model is a visco-elastic or visco-plastic medium. In such a medium, stress forces are not only proportional to specific strain but also to the rate of deformation. Each stress includes therefore, two components: static stress according to Hooke's law for elastic bodies and dynamic stress based on Newton's law for viscous liquids. Dynamic stress is expressed in rock movement towards openings, which can aid mining; but action of static stress cannot be visually observed.

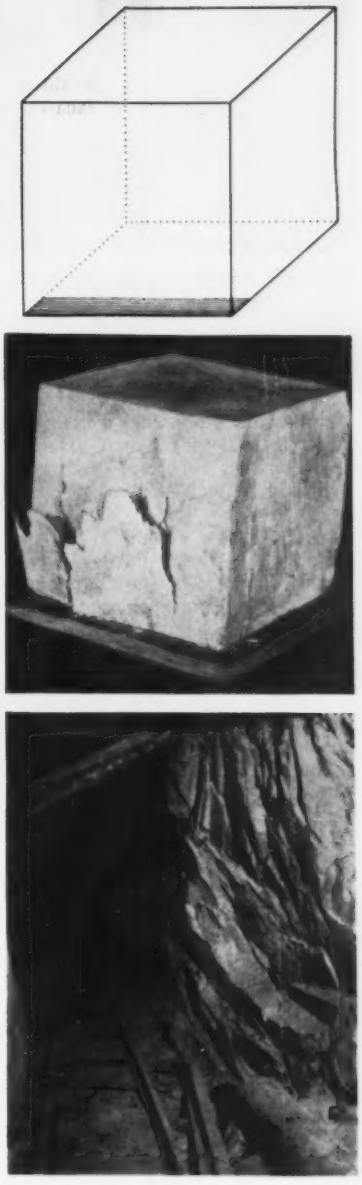
H. Hoffman (Aix-la-Chapelle, West Germany), described triaxial pressure tests and some particular features of strata control in Western Germany. Rock pressure in zones outside the immediate working excavations are being measured with electric remote reading instruments installed in boreholes 30 to 50 m long. Pressure and convergence in the stowed goaf is being measured to determine behavior of rocks in areas where working has been finished. These examinations are paralleled by geo-mechanical studies of drill cores under triaxial pressure.

Compressive strength of coal-measure rocks increase with confining pressure, without, however, converting into a true plastic state. With non-uniform over-all pressure, fracture patterns and angles depend on state of stress. Some deformations almost disappear upon deloading but do not follow Hooke's law. All tests where lateral extension is not permitted show an increasing elastic modulus. Mechanical properties do not depend as much on the material as on the arrangement of the particles and the nature of their cohesion. Inhomogeneities in the rock have little effect on the state of stress. In the interior mountain area, the theory of elasticity is the one that corresponds closest to reality. Uncertain factors are the influence of time and the rock humidity —phenomena not considered in the model tests.

H. G. Denkhaus (Pretoria, Union of South Africa) discussed properties of rock that affect rockbursts, having first reviewed the concept of a zone



CRACKING FAILURE has a different pattern when the pressure planes offer a frictional restraint than when they have a frictionless character. (Kvapil)



WEDGE-LIKE SLABS result when only a portion of one pressure plane has no lateral friction, as in a drift. (Kvapil)

of fractured rock surrounding excavations. While, from a physical point of view, the solid, virgin rock surrounding the fracture zone may be considered as a continuous elastic body, the fracture zone may be looked upon as a "Voussoirssystem" of blocks of fractured rock which is kept in equilibrium by friction and thrust between the individual blocks. Accordingly a distinction is made between extradosal bursts which originate from sudden failure of solid rock, and intradosal bursts which have their origin in the fracture zone.

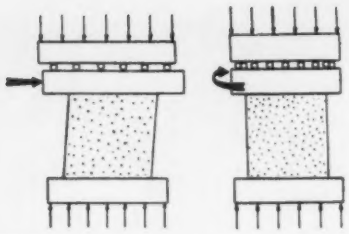
Fracture stress (strength), specific strain energy released at fracture (relative violence of fracture) and plastic deformability (ductility or, conversely, brittleness) and properties which indicate whether a certain type of rock is prone to extradosal bursts. These properties depend on multiaxiality of the state of stress and other factors. Elastic after effects and creep phenomena also have a bearing on the incidence of rockbursts. "Physical properties of rock" obtained from laboratory tests must be distinguished from the "structural properties of the ground in the fractured zone" which can only be determined in tests carried out at depth.

K. H. Hofer (Freiberg, East Germany) explained that creep in rock salts involves the same principles as in metallogy and plasticity research. When a critical shear stress has been exceeded there will be three stages in the course of creep: first, rate of deformation will decrease with time; second, creep velocity will remain constant; and, third, it will increase until fracture. Stress causing deformation in the elastic range governs the velocity of deformation beyond that elastic range—creep rate during the second stage being in logarithmic dependence. Thus it becomes apparent why many calculations of pillar dimensions based on the theory of elasticity do not comply with reality. Rock and coal studies by other authors point to the same laws as have been found for rock salts.

R. Kvapil (Prag-Kyje, Czechoslovakia) proposed that rock failure should be studied with a view to its sources rather than its effects, considering energy equilibrium and with particular emphasis on potential energy. Three classes of rock failure were considered: cracking, either with full friction at the pressure planes or excluding friction at the pressure planes; plastic flow; and splintering, either under abrupt load (e.g., rockburst) or by combination of stress.

S. G. Awerschin (Leningrad, USSR) commented that mathematical models of a elasto-plastic medium cannot give practical results until more knowledge of deformation and strength properties of the rocks is acquired from laboratory and field measure-

PLASTIC FLOW in model of pressure dome produces many patterns. (Kvapil)



SHATTERING FRACTURE may come from a combination of forces as well as from an abrupt loading. (Kvapil)

ments. Some studies that have been made are: events in the abutment zone or underground excavations; measurement of deformation and stress in coal pillars; and deforming characteristics of coal seams endangered by rock bursts.

A. D. Panow and K. W. Ruppeneit (Moscow-Panki, USSR) reported work in longwall strata control involving: studies of mechanical properties of rocks; analysis of the quality of pressure on supports and of roof movements; and model tests on rock movements at the face. These studies together with observations at the site enable an efficient and almost simple solution of even complicated questions in strata control. The results are already being used for support design in the Soviet Union.

F. Mohr (Essen, West Germany) said that rock movements in shafts subjected to mining influences indicate that an arch is formed above the working area and this reduces the rate of subsidence. Bending resulting from traverse movements plays as decisive a part as compression within the individual rock formations.

J. Venter and P. Stassen (Liege, Belgium) mentioned that rock and strata characteristics have not been given sufficient consideration when selecting methods of working. They then proceeded to outline principles to be observed in developing a deposit in soft rocks, procedure to be stipulated for exploitation, and types of support to be used, e.g.:

a) In cross-cuts, support will consist of a fully circular construction including a concrete brick lining with interconnected compressible spacer elements.

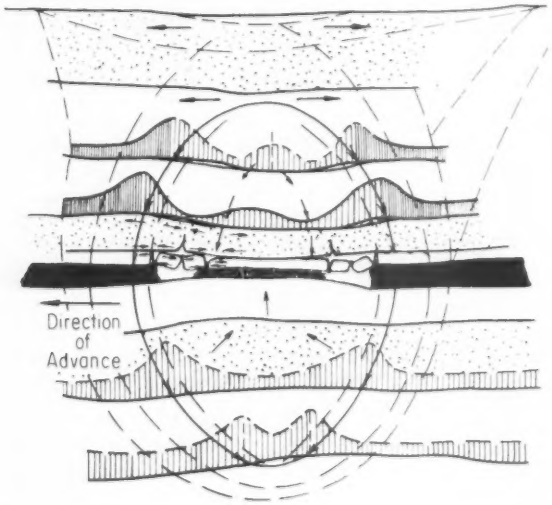
b) In roadways, the support will be formed of linked arches placed on yielding large-base wooden pillars and back-filled with dirt, thus covering the entire thickness of the seam. These arches, fully inserted into the roof, subside together with immediate surrounding rocks which, therefore, remain in their initial structural cohesion.

c) In longwall workings, the support will be yielding props with large end plates and a uniform load carrying capacity which yields under a constant load without penetrating into the roof or the floor. Under these conditions, hydraulic props with a rather low but adjustable bearing strength are most efficient.

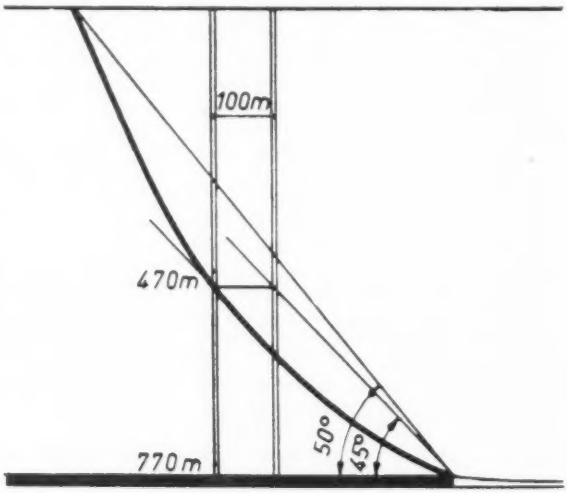
B. Schwartz, R. Buisson and R. Dubois (Nancy, France) discussed statistical methods to determine support efficiency and floor stability. In their work they found that, although the base plates greatly reinforce the quality of the support, the majority of their floor rocks are so soft that 20-ton hydraulic props will penetrate into the floor even with 400-sq cm base plates.

W. Dietze (Eisleben, East Germany) summarized the development of curved face working of the Mansfeld copper-slate. He emphasized that rock mechanics played an essential part in that development but was restricted by other operational factors such as haulage, et al.

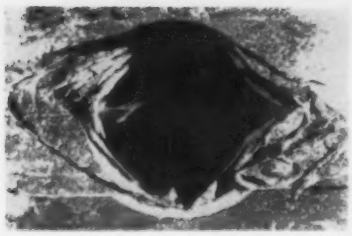
I. Litwiniszyn (Cracow, Poland) considered statistical methods for pre-



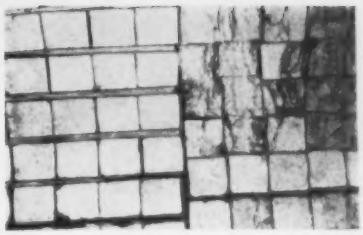
MOVEMENT AND PRESSURE around stope has circular flow with tension at top and pressure at bottom. (Awerschin)



LIMIT SURFACE IN SUBSIDENCE appears to be curved rather than planar in solid bedded rock, according to Mohr.



ELLIPTICAL FRACTURE ZONE forms with long axis parallel to higher stress around borehole in test. (Mohr)



FULL CIRCLE LINING of concrete brick remains intact when compressible "slide-bars" are used. (Venter & Stassen)

LINKED ARCHES resting on wood cribs subside with roof rock and prevent slabs from forming. (Venter & Stassen)

dicting rock movements resulting from underground workings. A new mathematical model (formula) shows a close resemblance to the mathematical theories of stochastic processes and of probability. It leads to a differential equation which defines the course of the subsidence trough. The subject model is a general one and may be used for heterogeneous and anisotropic agents.

F. Martos (Budapest, Hungary) elaborated on approximate equations of the subsidence trough profile and its time factor. They are Gaussian type based on recent measurements.

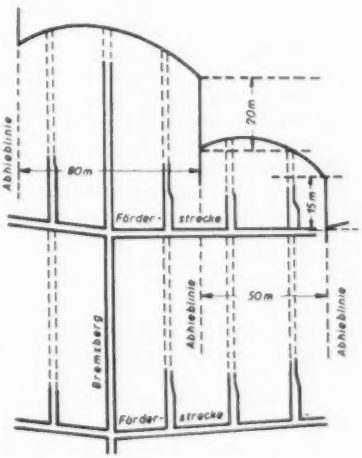
K. Wardell (Doncaster, Great Britain) examined concepts of limit angle and area of influence and pointed out how they may restrict the interpretation of ground movement observations if rigidly accepted. He concludes that there is only a qualitative agreement between surface ground movements observed in various European coalfields and that the reasons for the quantitative variations must still be sought.

W. Buchheim (Freiberg, East Germany) discussed measuring pressure distribution around mining excavations using physical methods which as much as possible prevent any mechanical interference with the state of stress. Seismo-sonic measurements are particularly suited for this. Sound wave velocity permits tracing the pressure in compact rocks which show good sonic conductivity (separately generated pulse method). Abrupt cracking sounds caused by pressure on brittle rocks are a clue to pseudoplastic destruction when approaching critical strength of fracture (self-generated pulse method). Soviet research, among others, has given quantitative empiric data on the rise in pressure in the seam with the advancing face. Experiments in Germany show that there is increasing plasticity of pillars under the action of the abutment load, and that it is possible to establish a sonic diagnosis of dangerous conditions in potash salt pillars.

A. Watznauer (Freiberg, East Germany) showed that a tectonic component in rock pressure must be taken into account. Disregarding abrupt events, estimations on hand assign an intensity of approximately 300 kg per sq cm to tangentially acting tectonic forces. Direction of the tangential pressure can be determined by structural analysis. Serious faults having a horizontal shifting tendency produce tectonic forces of an intensity which cannot be estimated so far.

W. Budryk (Cracow, Poland) reported that the location of earthquake centers prove that the mining districts of Upper Silesia cannot be considered as being stabilized in tectonic respect. Fairly severe tectonic concussions occur at a depth of 7 to 8 km. Although they rarely cause any serious damages on the surface, they are the source of many strong rockbursts. Epicenters are distributed along some parallel lines having an azimuth of 50 deg and prevailing in a width of 27 km.

E. Tschernig (Klagenfurt, Austria) covered rockburst studies in lead and zinc mining of the Eastern Alps. Release of stress is concentrated on certain faults striking north to northeast, with special emphasis on those parts of the faults that are particularly affected by tectonic forces. At Bleiburg, bursts are most frequent in the early afternoon, in the fall of the year and at a depth of about 2,000-ft. Pressure studies have not only cut the number of bursts but also cut the explosive consumption.



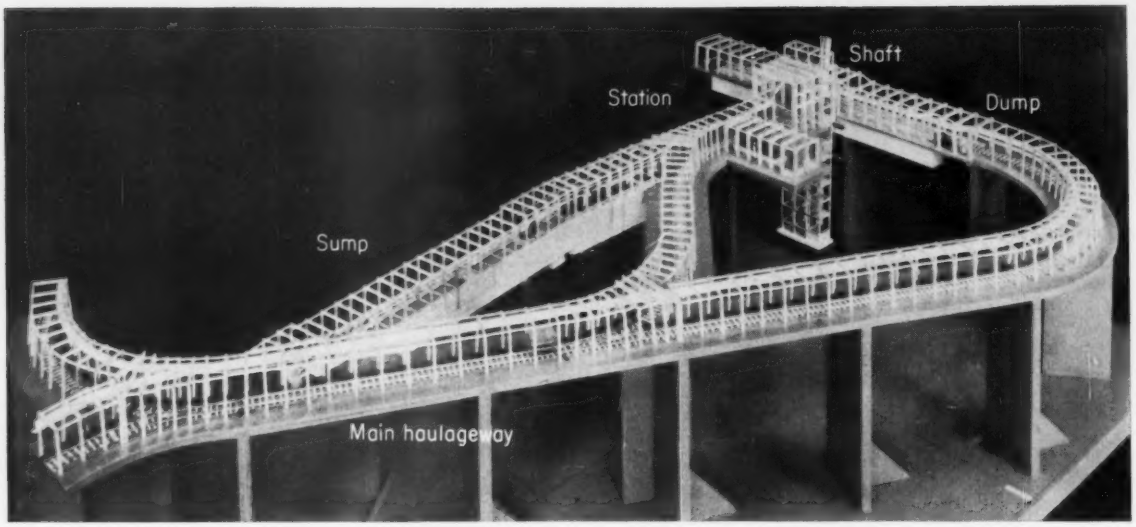
CURVED FACE is advanced in resuing a flat thin bed of copper slate. (Dietze)

A. P. Sudoplatow and W. I. Baranowski (Moscow, USSR) stated that when exploiting flat lying coal seams in the Donez field, flow of rock causes great complications in the preparatory workings. It arises in argillaceous rocks essentially due to rock pressure, but a minor role is played by humidity. Underground measurements and model tests show two zones of rock movement. One is situated above the worked field and shows the shape of an arch. The rocks in this zone lose cohesion with the main roof and gradually subside onto the floor. The other zone is to be found on both sides of the worked field. In this zone the rocks move toward the worked field, without, however, losing their complete cohesion with the main roof. Rock pressure developed around the working areas rises at the face in the coal bed and the coal pillars, whereas in the floor the pressure decreases and is a minimum at the base of the face.

E. Tincelin and P. Sinou (Briey, France) summarized results of eight years' research and practice in strata control in the iron ore mines of Lorraine.

G. Spackeler (Freiberg, East Germany) reviewed some observations on stress around coal and salt workings. Basing calculations and measurements on deformation lacks precision. Visual data remains important. Stresses are higher than determined so far. Shear is responsible for most failures.

The prior International Strata Control Congresses (Leoben-1950, Liege-1951, Essen-1956) were reviewed.



SHAFT STATION, under construction, will include slusher-trench dump-pocket, settling sump for mine drainage and sub-station.

San Mateo Drives Toward Production

DESPITE deep ore, wet ground and uncertainty over the AEC's ore buying policy, by midsummer Rare Metals Corp. of America expects to be producing 600 tpd from their San Mateo uranium ore reserve in New Mexico. An 1100-ft shaft is now near completion and excavation of the 1047 main-level station is well along.

The million-plus-ton reserves of 0.20% U_3O_8 are located sowthwest of the major mining areas of the Ambrosia Lake district in Sections 29 and 30, R8W T13N. Occurring in the 8-deg dipping Poison Canyon sandstone, the orebody was discovered by Rare Metals after other companies turned down the prospect largely because they felt any ore found in the Poison Canyon (common source of uraninite in the district) would be too deep for economic mining. Eventually the shaft may reach 1,400 ft.

Above and below the ore horizon are formations which carry considerable water—the Dakota and Westwater sandstones. While not plagued with an unconsolidated Westwater as are some operators in the district, Rare Metals is setting up the mine to handle 1,400 gpm water flow if necessary. But, on the basis of drill holes and shaft sinking to date, M. H. Kline, vice-president of the Salt Lake City affiliate of El Paso Natural Gas Co., does not expect to pick up much more than 750 gpm during regular mining. Most of this will come from Dakota, which despite two months of strenuous work during shaft sinking, could not be sealed off.

Formal purchase allocations have not yet been received from the AEC in connection with the agency's 1962-1966 plan. But only two firms in the district have received such allocations and Rare Metals' major reserves were blocked out well before the November 24, 1958, announcement on curtailment of domestic uranium expansion was published in the *Federal Register* at Washington, D.C.

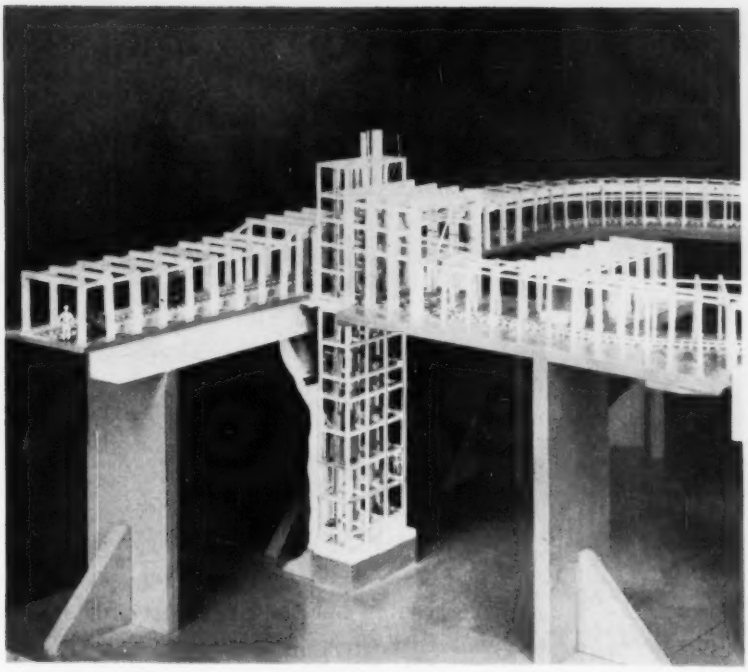
Exploration by Rare Metals at San Mateo started in March 1957. Ore was not found until the 21st rotary drill hole cut 17 ft of uranium ore. Simultaneous drilling on other leases closer to major existing mines failed to find any ore. However, at San Mateo, one major deposit about a mile long and three somewhat smaller deposits have been outlined.

Rare Metals commenced shaft sinking in December 1957 and by mid-year 1958 halted surface drilling in favor of underground exploration. Such exploration, as well as actual mining, is expected to add substantial reserves. Shaft sinking is being done by Centennial Development Co., Eureka, Utah, under direction of Rare Metals personnel.

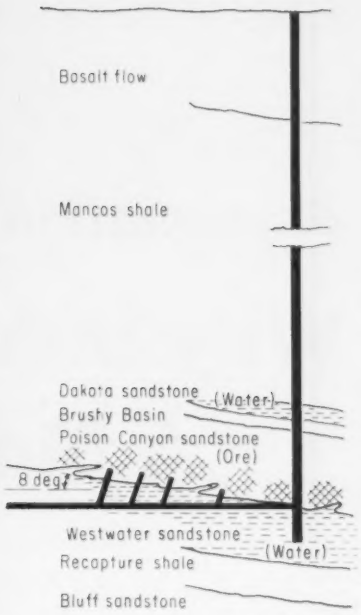
In sinking the three 5x6-ft compartment shaft, Centennial encountered water-bearing Dakota at 871 to 881 ft. The Dakota appeared highly fractured, "with some fissures or fractures as big as an arm," it is related. Because of this, Halliburton, an oil-well cementing firm, was called in with hopes of effecting a water seal-off similar to that used in the Carlsbad, N.M., potash district.

First, a circle of ten holes was drilled around the shaft at a radius of 30 ft. Then a concentric ring of four holes was drilled at 10 ft from the shaft center. Next, a 20-ft cement plug was poured in the shaft bottom to cover the entire 10 ft of exposed Dakota and provide a bulwark against cement grout which was then pumped into the concentric rings of drill holes. Pressure was limited to 1,000 psi to prevent any "break-down" of forma-

HEADFRAME will have bin to load trucks taking ore to graded stockpiles.



SKIP LOADING will employ remote-controlled slushers and measuring chutes.



WATER in Dakota slowed shaft sinking. Dip of ore and tongues of water-filled Westwater are considered in mining plan.

tion structure which would result in an increase in fractures rather than their sealing.

Along with the cement grout, "lost circulation" material such as gels and cellophane were introduced in hopes of increasing the seal. After the grout was allowed to set, the shaft plug was drilled and blasted with small charges.

Unfortunately, the effort was a failure. Water came in as before, in initial flows of more than 700 gpm. With two months wasted, sinking was continued in water.

Then, as the shaft went down through the Dakota, the miners noted that the water level dropped—some indication, at least, that drainage could be handled by pumping.

At about the 900-ft level, ten feet below the bottom of the Dakota, the contractors installed a collection trough ring around the shaft and cut a pump station with sumps. The trough funnels the water from the face, through an 8-in. pipe to two 5,000-gal concrete-lined sumps from which two electric pumps of 700 gpm total capacity lift the water to the surface. Thus the water is prevented from reaching the 1,047-ft main-level station and the shaft bottom.

In mining at San Mateo, there will be other water problems. Company engineers are aware that the orebodies and the Poison Canyon sandstone host rock have a dip of about 8 deg. Therefore, to maintain haulage at a 1 deg grade, the underlying water-pregnant Westwater sandstone will have to be cut as mining progresses. On the basis of drill hole knowledge, it is also apparent that additional water will be picked up in those places where the Westwater "tongues" into portions of the ore horizon.

The mining plan involves a mile long drift under the main orebody plus crosscuts as needed. Chutes on raises will be used to load ore cars. Ore will be slushed into the raises from the mining faces.

Water will be gathered in ditches along the haulageways and will flow into a 100x7x8-ft deep sump at the 1,047 shaft station. To eliminate pump wear, sand and other material will settle in this sump and be periodically raked-out and hoisted to the surface. A pumping capacity of 700 gpm will be installed at the sump to handle the 500-gpm maximum water flow expected when mining is underway.

Ore haulage trains of ten cars will be standard in the mine. Electric-battery locomotives will move trains to shaft area and up a slight incline to where they will be side-dumped by hand into a slusher-trench storage pocket cut from rock. The dump will be 100x5x6½ ft deep and will hold 1,500 tons of ore. The accumulation of ore at drawpoints and in the pocket will provide sufficient storage to permit continuous hoisting at the planned rate of 600 tpd.

A measuring-type chute will be sited below the storage pocket. It will be an air-operated unit to automatically load 50 cu ft into 60-cu ft hoisting skips with minimum spillage. Such a skip capacity is about 2½ tons and hoisting rope will be 1⅛ in.

At the surface, the 90-ft headframe will have an integral ore bin. Ore will be trucked from the bin to segregated stockpiles nearby. Control of ore disposition will be effected through sampling at the face by an underground geologist—a common practice in the Ambrosia Lake district.

Bulk of the ore from San Mateo will be shipped on custom basis to mills in the district. However, some ore may be hauled about 200 miles to the 300 tpd Rare Metals mill at Tuba City, Arizona.

For mine ventilation, a 32-in., steel-cased shaft has been completed about 800 ft northwest of the main production shaft.

All power for the mine, hoist and surface plant will be supplied from normal commercial electric sources in the district. Standby diesel generator units operating on natural gas will provide emergency power.

Some 50 miners will be employed in producing ore when the mine becomes operative in midsummer.

Depreciation Reform—

Why Industry Needs A Modern Tax Policy

A shockingly large proportion of our industrial plant and equipment is obsolete. As indicated by an earlier editorial in this series, over $95 billion would have to be spent —and spent soon—to bring our industrial facilities up to the best modern standards. Yet plans for 1959 call for little more than $30 billion of actual spending—barely enough to make a start on this backlog of modernization.

At the heart of the problem of obsolescence is a federal tax policy that discourages business from replacing inefficient facilities. It is the purpose of this editorial to spell out a tax reform Congress can make this year—with little cost in terms of tax revenue—that would go a long way toward removing the barrier to modernization of plant and equipment. This reform is a more realistic system of tax deductions for depreciation and obsolescence of productive facilities.

A Barrier to Modernization

Industry abounds with examples of old and obsolete facilities—despite large expenditures made in the past few years. Two-thirds of our metalworking equipment is over ten years old. Over half the capacity of our chemical process industries was installed before December 1950. Only a minor fraction of our railroad freight moves in new freight cars or the new push-button freight yards.

The tax law bears a large part of the responsibility for this lag in modernization because of its important influence on business investment in plant and equipment. For many years the tax law has permitted as a deduction from income "a reasonable allowance" for wear and tear and obsolescence of productive facilities. These annual deductions affect business investment in several ways.

- They are the way a company recovers its investment in plant and equipment.
- They determine in large measure, the amounts of money that are spent each year to replace and modernize facilities.
- Furthermore, the schedule for depreciation often determines **when** a specific machine or building is actually replaced.

The law requires that depreciation deductions be spread over the "useful life" of a building or machine. But the periods of useful life for tax purposes today still depend heavily upon tables drawn up by the Treasury almost 20 years ago. These tables reflect the replacement practices of depression years. Also, they were compiled at a time when the pace of technological progress in industry was much slower than it is now. **For nearly all types of equipment the indicated period of useful life is longer —sometimes much longer—than most experts consider realistic at today's rate of technological advance.**

The result of these outmoded depreciation schedules is that the recovery of investment is dragged out, and the replacement of obsolete equipment is delayed.

In The Right Direction

Congress should establish, by law, the right to use shorter depreciation periods on productive equipment. It should do so in a way that would free industry from obsolete concepts of the rate of technological change and would provide incentives to install new equipment and produce new products.

The tax reform act of 1954 made some progress in this direction—but not enough. It introduced new methods for calculating depreciation—the declining balance and the sum-of-the-years' digits—which enable a business to recover most of the investment in a new facility in the early years of its useful life. However, these new methods do not accomplish their desired purpose when the supposed "useful life" is still an unrealistically long period of years.

Industry is by no means free from blame for the failure to bring depreciation policy into line with the needs of a modern, growing economy. According to Joel Barlow, president of the Tax Institute, "management has largely ignored the Commissioner's invitation . . . to come into the Internal Revenue Service office and make a case for shorter depreciable lives by establishing technological obsolescence."

The failure of many companies to see their own interest in more realistic depreciation not only holds them back from modernizing their own facilities but also lends support to the Treasury in its continued adherence to an outdated policy.

A Suggestion For Reform

An excellent model for reform of the depreciation policy in our tax law is the system used successfully in Canada for a decade. In Canada, all productive equipment may be depreciated at relatively fast rates assigned to each of 14 broad categories. The Canadian system permits depreciation up to twice as fast as the antiquated tables of useful lives now followed in the U. S. It also gives the individual business far greater flexibility in determining depreciation schedules that fit its own needs and experience.

For example, in the category or "bracket" covering general machinery a taxpayer in Canada may depreciate up to 20% of the machine's value annually, on a declining balance basis. In the U. S. the fastest rate at which many types of machinery can be depreciated is only 10%. In other categories, from tools and dies to buildings and pipelines, the Canadian system also allows faster depreciation and provides greater incentive to invest in new facilities.

The cost of this reform in terms of lower tax revenue would be small—probably less than $500 million in the first year. And even this would merely be postponed, not permanently lost. Indeed, there is a very good prospect that tax revenue would not suffer at all. The increase in spending for new plant and equipment resulting from this tax reform would mean an increase in wages and profits—and therefore in taxes—in industries that produce machinery and other capital goods.

A realistic tax policy on depreciation would provide a badly needed incentive for industry to replace obsolete and inefficient facilities with up-to-date plants and equipment. It would step up our rate of technical advance and economic progress. And it would put U. S. industry in better shape to meet the growing competition from other countries that have grasped the advantages of fully modern technology.

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Donald C. McGraw

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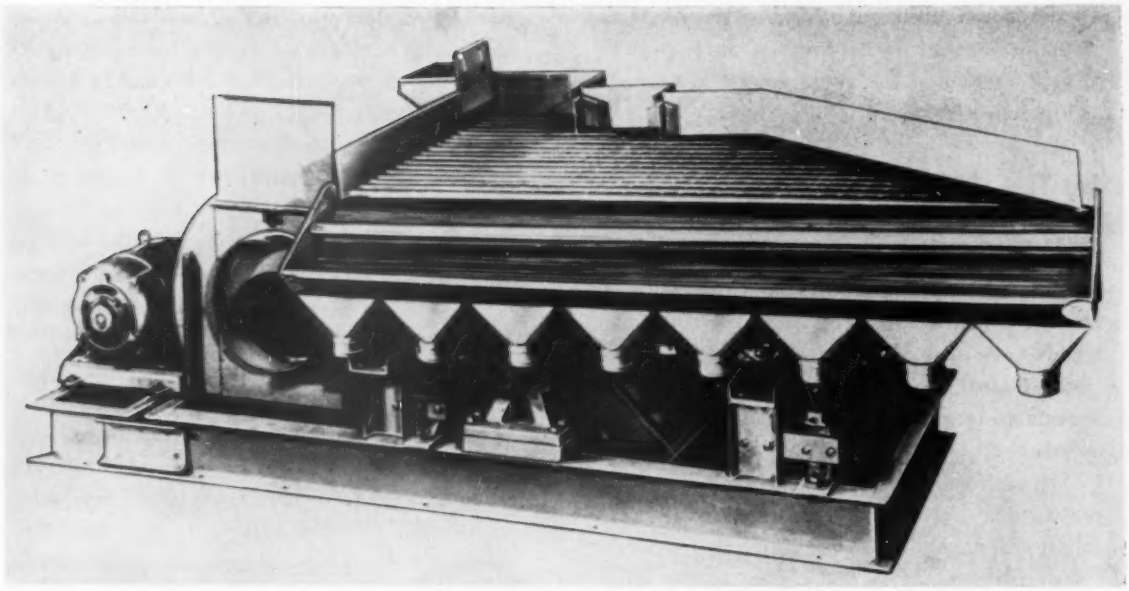


"A PNEUMATIC JIG" is one term used by the authors to describe the dry concentration air tables in use at Gossan Mines. The process handles a relatively coarse product, requires no water and is inexpensive to install.

Virginia Plant Concentrates Sulphide Ore With Air Tables

ROBERT H. DICKSON
WILBERT J. TREPP
JAMES O. NICHOLS

THE GENERAL CHEMICAL DIVISION of Allied Chemical Corp., in supplying pyrrhotite ore from its Gossan Mines near Galax, Va., uses air float tables to treat sulphide ore. The ores are shipped to the firm's acid plant at Pulaski, 35 miles away. At the acid plant, the ore is burned to furnish SO_2 and the resulting cinder shipped to iron blast furnaces. Reaction heat produces steam power.

The ore, which has supplied the acid plant since 1904, occurs in the Lynchburg Gneiss. As mined, the sulphides make up about 65% of the total. The gangue minerals are comprised of chlorite, muscovite, biotite, feldspar and quarz. Pyrrhotite contains about 61% Fe and 39% S and has a specific gravity of about 4.6. Gangue minerals are lighter and break up more easily than the sulphides. In crushing the ore to minus 3 mesh, about 85% of the sulphides are coarser than 48 mesh.

Mr. Dickson and Mr. Trepp are manager and assistant manager of mining operations for the General Chemical Division of Allied Chemical Corp., in New York, and Mr. Nichols is superintendent at Gossan Mines, Galax, Va.

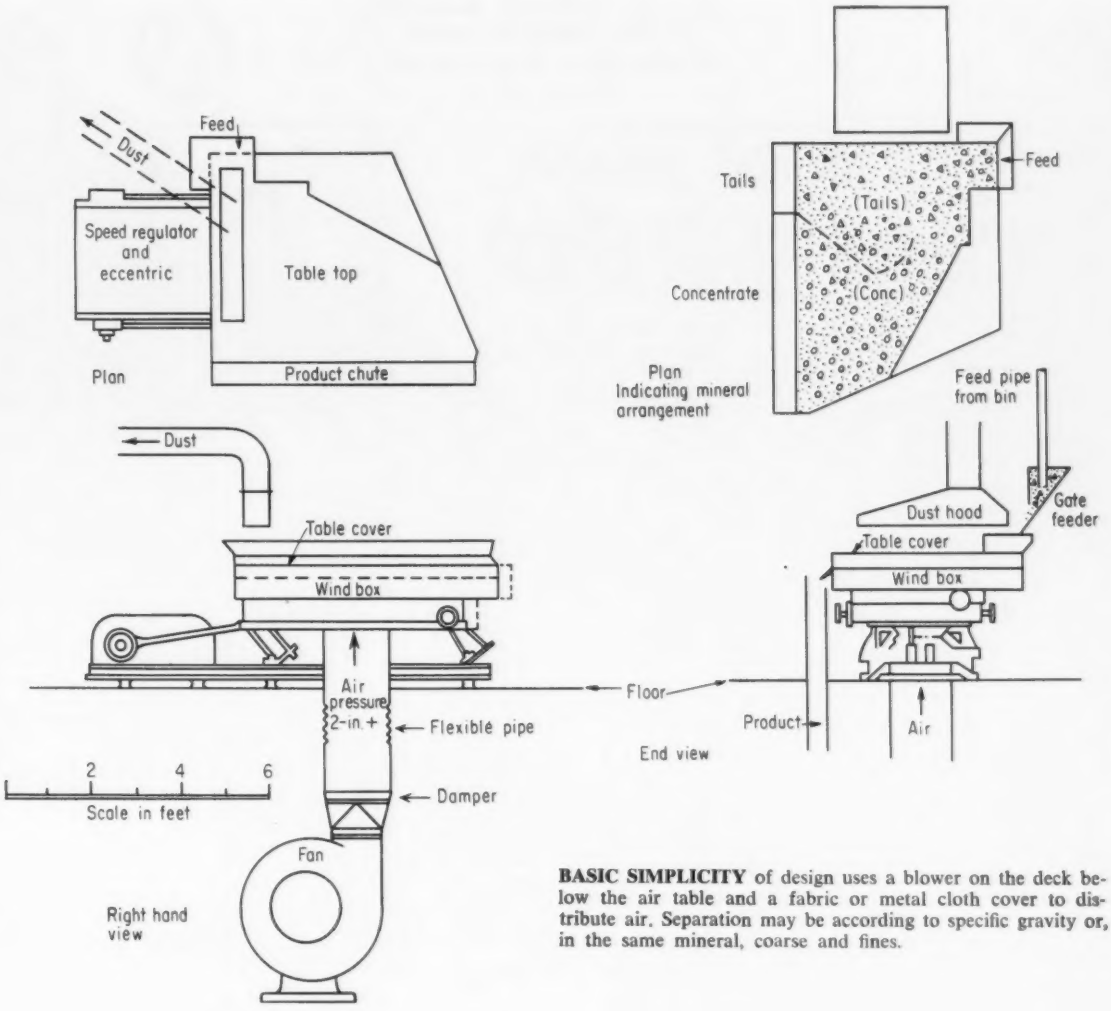
There had been a wet flotation plant in operation at Gossan during 1928 and 1929 which made a very fine sized (65% minus 200 mesh) concentrate. The present dry concentrator, including the tables, was designed in 1938 to make a dry iron sulphide product less than 3 mesh in size and averaging about 33½% S.

Air float tables are concentrators in which the separating medium is air rather than water. Such machines have been used on ore concentration for 70 years. G. W. Jarman, Jr. described their operation (AIME—TP 959) in 1937 as having been used in the concentration of ilmenite, scheelite and many other minerals.

Concentration by Sutton Steele & Steele air float tables offered certain advantages at the time when the plant was designed, including 1) a comparatively coarse product, 2) no water supply was required and 3) installation was relatively inexpensive. The original concentrator was erected in 1938. After a fire in 1944, the original Sutton Steele & Steele tables were replaced by newer models, but the unclassified fines (minus 48 mesh) were treated by jigs and wet flotation.

The air float table is a pneumatic concentrator in which an upward current of air is used to separate mineral particles according to physical properties. The essential parts are a moving deck with a porous cover over which the mineral rides, an air supply flowing upward through the porous cover and a vibrating mechanism giving the table vertical and lateral movement. While similar to the shaking tables used for water gravity concentration, it more properly could be classified as a pneumatic jig.

The table, or separator, classifies free flowing granular mixtures according to shape and specific gravity. With particles of the same size (within reasonable range), the material flowing over the side ranges from lower to higher specific gravity. By separating the overflow into sections, high and low specific gravity products can be withdrawn. Should the particles be all the same mineral, then the table could act as a classifier with finer particles at one end of the overflow and coarser at the other. In practice the mineral particles vary somewhat in size, shape and specific gravity. A term in the literature of hydrodynamics, "terminal velocity", describes the property of the particle



BASIC SIMPLICITY of design uses a blower on the deck below the air table and a fabric or metal cloth cover to distribute air. Separation may be according to specific gravity or, in the same mineral, coarse and fines.

in motion taking into account these various physical attributes. The mineral particles literally float in air above the deck and are stratified into a layer of light particles floating over a stratum of heavier ones. The shaking and slope of the table cause the light stratum to move to one end of the overflow side and the heavy stratum to the other.

For ideal operating conditions, the individual mineral particles should be free and of nearly the same size and shape. At Gossan Mines the pyrrhotite is free at about 3 mesh. Between 3 and 48 mesh, the ore is screened into four sizes:

Mesh	Approx. percent of total	Treated on
− 3+ 8	42%	Coarse deck
− 8+20	27%	Medium deck
−20+48	16%	Fine deck
−48	15%	Wet flotation

Minus 48 mesh material is unclassified, ranging from less than 1 to 300 microns in size. It carries less sulphides than the head feed and at times is dusty. The material is treated by wet flotation and the concentrate dried. Coarser sizes (plus 48 mesh) are treated on air tables.

A flowsheet of the processing technique appears on p 116.

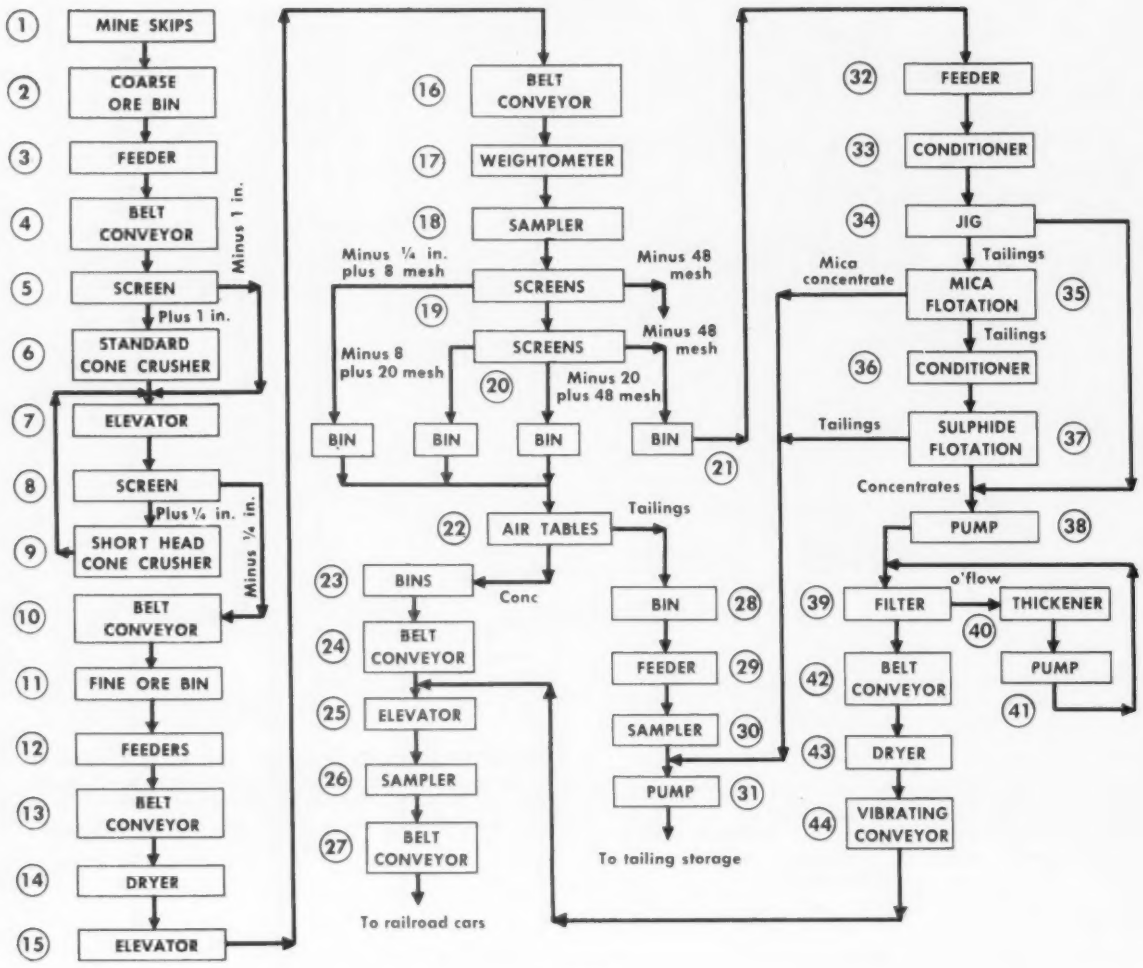
Ore preparation is by conventional methods. The concentrator has a capacity of 1,000 tpd. Ore is crushed to minus 6-in. size in the mine by a Traylor 18x30-in. Blake type crusher and is hoisted in skips to the coarse ore bin at the head of the mill.

Ore is withdrawn from the coarse ore bin by a Robbins Shaking Feeder, 33-in. x 7-ft, at the rate of 70 net tons per hour and is conveyed to a No. 1 Screen, a Tyler Niagara 4x6-ft vibrating screen with 1-in. square openings. Oversize passes to No. 1 crusher which is a 4-ft. Standard Symons cone crusher with a setting of ¾ in.

Data in Table Operation

Designation	No. 1	No. 2	No. 3
Percent of total feed	42.0	27.0	16.0
Screen size	−3+8 mesh	−8+20 mesh	−20+48 mesh
Number of tables	3	3	3
Size of vibrator	V 50–70	V 50–70	V 50–70
Deck cover	16 × 16 screen cloth	3½ copper	#2 linen
Tons/hr. feed each table	8	6	4
Air pressure	4" H_2O	2⅛" H_2O	1" H_2O
Size of blower (American)	#4 AHS	#3 AHS	#3 AHS
Blower motor	15 hp	7½ hp	5 hp

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORP.
Gossan Mines Concentrator
Galax, Va.

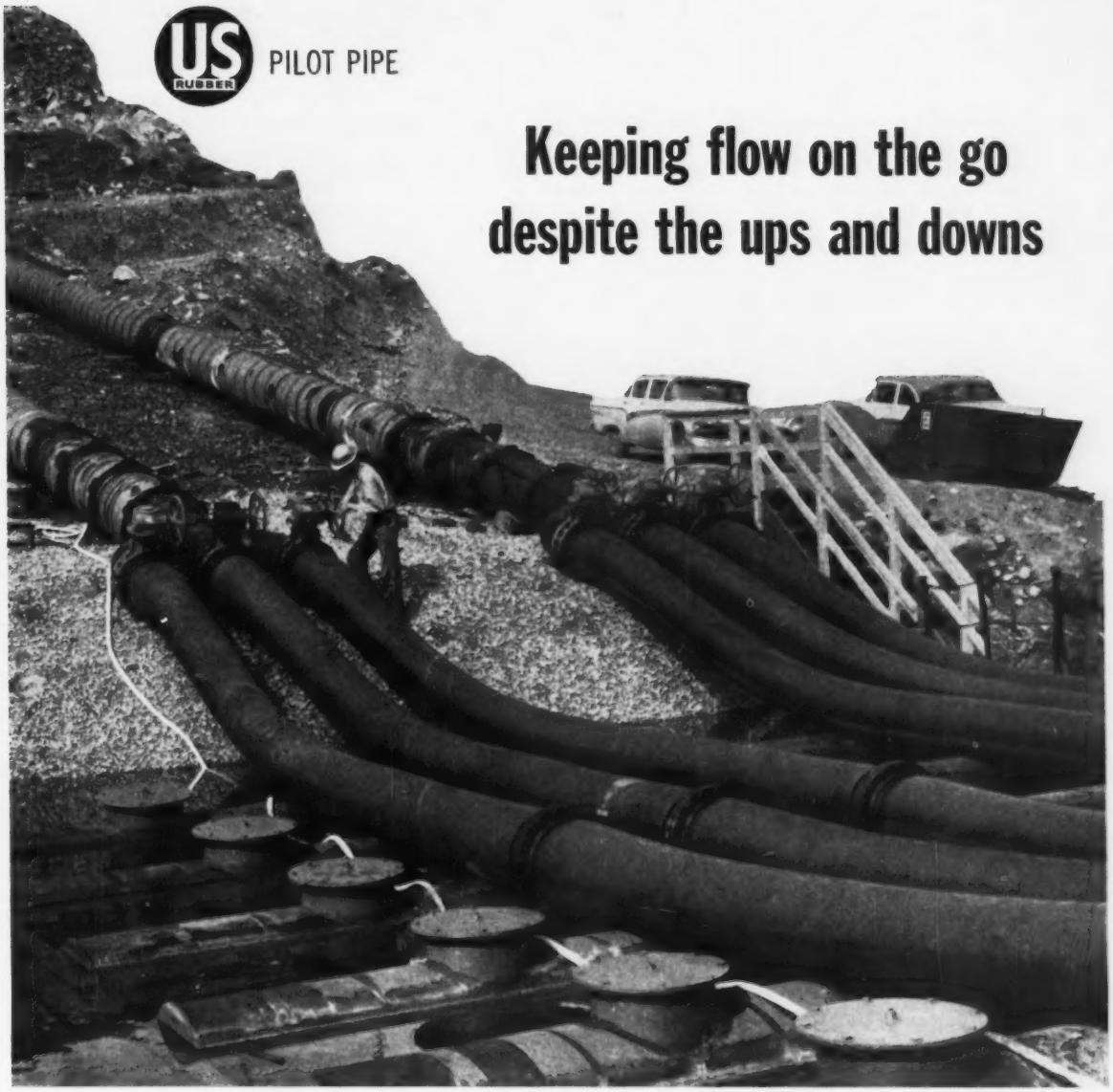


LEGEND

1. 5-ton combination skip-cages, Kimberly type
2. 100-ton, live load, ore bin
3. Robbins 33-in x 7-ft reciprocating feeder; feed rate, 76 tph
4. 24-in. x 34-ft belt conveyor, stationary magnet overhead pulley
5. 4x6-ft Tyler Niagara screen, 1-in. sq opening
6. 4-ft Symons Standard Cone Crusher set at ¾-in.
7. 8-in. x 12-in. x 57-ft high bucket elevator
8. 4x8-ft Allis-Chalmers double deck vibrating screen. ½-in. punched plate top deck, ¼-in. screen lower deck
9. 3-ft Symons Short Head cone crusher set at 3/16-in.
10. 18-in. x 37-ft belt conveyor
11. 20-ft dia steel fine ore bin. Capacity of 500 live tons
12. Two Jeffrey 3MC vibrating feeders, feed rate 40 tph
13. 16-in. x 60-ft belt conveyor
14. 6-ft dia x 36-ft long Vulcan rotary dryer, coal fired
15. 8-in. x 12-in. x 55-ft high bucket elevator
16. 18-in. x 75-ft belt conveyor
17. Merrick Model E Weightometer
18. Galigher Co. Geary-Jennings automatic sampler
19. Two Tyler 3x10-ft double deck Hummer screens, 8 mesh Tyrod screens, top deck; 48 mesh s.s. Ton Cap screen lower deck
20. Same as No. 19 except 20 mesh. Ton Cap screens top deck; 48 mesh Ton Cap screens lower deck
21. Four 50-ton steel bins
22. Nine Sutton Steele & Steele 50x70-ft air separators. Three for each size product
23. Two 50-ton concrete and steel concentrate bins
24. 18-in. x 36-ft belt conveyor
25. 5-in. x 8-in. x 53-ft high bucket elevator
26. Galigher, Geary - Jennings automatic sampler
27. 18-in. x 20-ft belt conveyor
28. 50-ton concrete and steel dry tailings bin
29. Jeffrey 3L vibrating feeder
30. Denver Equipment automatic sampler
31. Two Morris 3R slurry pumps
32. Hardinge constant weight feeder, feed rate 8-tph
33. 3x5-ft Denver conditioner
34. Denver 12 x 18-in. Duplex mineral jig equipped with Denver Dowsett automatic hutch valves
35. Denver No. 250 unit cell
36. Denver 5x5-ft Super Agitator-conditioner
37. Two flotation banks. One 4-cell No. 36 Agitair; one 2-cell Denver No. 18, and 2-cell No. 36 Agitair
38. Wilfley 2-in. sand pump
39. Dorrco 8x4-ft filter. Nash L-5 vacuum pump; Hydroseal 1½-in. filtrate pump
40. Denver 24-ft dia x 20-ft high thickener
41. Denver 4-in. Simplex diaphragm pump
42. 12-in. x 16-ft belt conveyor
43. 5x36-ft Vulcan rotary dryer
44. Witte 24-in. vibrating conveyor

US RUBBER PILOT PIPE

Keeping flow on the go despite the ups and downs



A taconite mining company in Minnesota operates 365 days a year, has capacity to produce 7,500,000 tons of iron ore pellets a year.

To produce a ton of taconite pellets requires over 100 kwh of electric power and 25 tons of water. This plant, at its present production rate, pumps almost 65,000 gallons of water a minute. It is utilized so carefully that the make-up water requirement is held to less than 5,000 gallons a minute.

Two large diameter metal pipes lead from the barge pumping station to the concentrator. Three 16" U. S. Rubber Pilot® Pipe lines connect each pipe with the barge pumps. "U. S." Hose is used because due to rain or snow the barge may rise 7 feet or more, or sink as much as 10 feet, straining the hose and connectors.

U. S. Pilot Pipe is extremely flexible, yet very strong. Withstands up to 250 lbs. pressure, and extreme temperatures ranging to 45°F below zero. The plant cannot operate without water, hence "U. S." Hose is the *water lifeline*. Its dependability explains why U. S. Rubber is the world's largest manufacturer of industrial rubber products.

• • •

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Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Undersize passes to No. 1 elevator, a Jeffrey continuous bucket elevator, and then to the No. 2, an Allis Chalmers double deck 4x8-ft vibrating screen with ½-in. punched plate for top deck and ¼-in. opening wire mesh on bottom deck. About 45% of the feed is minus ¼-in.

All oversize (plus ¼-in) passes to the No. 2 crusher, a 3-ft Symons short head cone crusher set at 3/16-in. The product drops into No. 1 elevator which carries it to No. 2 screen.

Undersize from the No. 2 screen is conveyed by No. 2 conveyor, 18-in. wide, to a 500-ton fine ore storage bin, 20-ft dia by 28-ft high. The mine operates two shifts and the bin is a surge tank from which ore is withdrawn continuously on a three shift basis.

Minus 3 mesh ore is withdrawn from the fine ore bin at a rate of 40 tons per hour by two Jeffrey No. 3 MC pan feeders, 24-in. wide, onto a belt conveyor, 16-in. wide, which carries it to a Vulcan rotary dryer, 6-ft. dia by 36-ft. long, where moisture is reduced to less than 0.4% H_2O. Discharge from the dryer is conveyed by No. 2 elevator, a Sprout-Waldron continuous bucket elevator, and belt conveyor, 18-in. wide, passing over a Merrick Weightometer, and then a Geary-Jennings sampler to the head of the screening section.

The ore stream is split equally into two parts, each passing over two 3x10-ft double deck Hummer screens with V16 vibrators. The first screen of each set has two 3x5 sections, the upper deck being 8 mesh Tyrod and the lower, 48 mesh Ton Cap. The minus 3 plus 8 mesh and minus 48 mesh products pass into their respective bins.

Intermediate size from the first screen (minus 8 plus 48) mesh passes to a second screen with two 3x10-ft screens, the upper deck being 20 mesh Ton Cap and the lower, 48 mesh Ton Cap. The products, minus 8 plus 20 mesh, minus 20 plus 48 mesh and minus 48 mesh, pass into their respective ore bins. (Slotted screens are used, hence the designations are not exactly Tyler screen scale sizes.)

The drawing shows the essential parts of the table. A fan located on the floor below the table floor furnishes clean filtered air under pressures (of ½-in. to 4-in. of water) to the windbox below the table deck. Quantity and pressure of air can be varied by a damper in the pipe line. Over the windbox is the table cover consisting of linen or copper cloth which is the working face of the table. The cloth deck breaks the air column into a great number of fine streams which blow the mineral particles upward. There are no riffles.

The fine ore bins, each containing sized material, are above the table floor. Ore is withdrawn through a 3-in. pipe into a small feed hopper at the corner of the table. Amount of feed is regulated by a sliding gate.

Ore feed moves across the shaking table, where it is subjected to an air stream from below and a vibrating motion. The air column, moving upward through a mixture of ore particles differing in "terminal velocity", stratifies the mass with the heaviest particles near the bottom, and the lighter ones and those with less terminal velocity at the top. The motion of the table and pressure from new feed causes the heavy particles, some of which touch the table, to move lengthwise. Lighter particles move directly across the table by gravity. Air pressure is adjusted to make the whole mass of particles float over the top of the table with no "dead" or "too live" spots. The product passing over the lip of the table varies from waste at one end to pyrrhotite at the other with all gradations in between. A separator divides the two products, tails and concentrates.

The Gossan mill has 10 Sutton Steele & Steele tables, one in reserve and three on each of the three classified sizes. The tables are driven by a 2 hp motor through a Reeves variable speed drive. Strokes vary from 320 to 340 per minute. Each table has its own blower which requires a 5 to 15 hp motor depending upon air pressure. All air is pre-filtered by a Dracco (155 cotton filter bags, 6-in. x 5-ft) air filter.

Only two products are made; concentrates and tails. Head feed varies in grade from time to time, and the operators, using their experience, set the divider. A typical feed is 25% S with concentrates 33.7% and tails 8% S. Products drop through rectangular steel chutes into product bins.

Dust is removed from the top of the table through a hood. Suction for dust removal for all nine tables is furnished by three Buffalo MX size 40 exhausters discharging into three 48-in. cyclone collectors.

Up until 1944, the unclassified feed (minus 48 mesh) was treated on air float tables, and the sulphide recovery was about 45%. Since 1945, the fines (minus 48 mesh), which amount to about 15% of the total feed, have been concentrated by a Denver mineral jig followed by wet flotation.

The relative proportion of various gangue minerals in the feed varies from time to time. Operators make table adjustments as they deem necessary. One operator on a shift takes care of the table floor. Repairs to the tables are relatively small.

Waste from the tailings bin is withdrawn by a Jeffrey No. 3L 12x60-in. vibrating feeder into a cone-shaped slurry tank where they mix with flotation tailings and added water to make a 20% solids slurry.

The slurry is pumped by two Morris 3R Figure 3B and 3E slurry pumps through about 1,000 ft of 3-in. pipe to the tailings pond.

Concentrates are withdrawn from the concentrate bins to railroad cars by a belt conveyor and elevator.

AIME (*Continued from p 92*)

with provision for expansion to 18,000 tons.

With the possible exception of a recent blast furnace developed in England, the vertical retort process is the only continuous pyrometallurgical process that has achieved success and is assured a permanent role in zinc smelting. This was the view expressed by G. T. Mahler and J. A. Marvin, Jr., of the New Jersey Zinc Co., who presented a paper "Improvements in Vertical Retort Process for Zinc Smelting." They reported that the capacity of vertical retort plants in the U.S. and abroad now exceeds 300,000 tons per year.

Marcel Marechel and Georges Biquet of Compagnie Royale Austrienne des Mines, said that the Auby plant in France represents the most modern example of the vertical retort process. It embodies all the improvements made as the result of 30 years' experience with the process, they said.

The complexity of smelter operations at a secondary aluminum smelter were discussed in considerable detail in Wilfred H. Stewart's paper "Problems Unique to the Secondary Aluminum Industry." The paper stresses the quality and range of materials that must be blended to produce economic smelter charges.

Fluidized beds have been used successfully in the laboratory to condense high melting point vaporized solids, according to L. Wallace Coffer and F. M. Stephens Jr. In their paper, "The Use of Fluidized-Bed Reactors as High-Temperature Condensers," the authors showed how the unit can be used to condense metallic or salt vapors on particles in the reactor. Potential applications and test results were also pointed out.

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NEW BOOKS

Minerals Yearbook, Volume III, Area Reports, 1956. Published by U.S. Bureau of Mines. May be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $4.25 (cloth).

Trouble-Free Hydraulics, by Ian McNeil. A practical handbook on the maintenance and fault finding in oil hydraulic machinery. Published by Ronald Press Co., 15 East 26th St., New York 10, N.Y. Illustrated in 121pp. Price $6.50.

Engineering Manual: a practical reference of data and methods in architectural, chemical, civil, electrical, mechanical and nuclear engineering, edited by J. H. and R. H. Perry. Every phase of engineering is covered. Published by McGraw-Hill Book Company, Inc. (address above). Illustrated in 680pp. Price $9.50.

Technology of Niobium, edited by B. W. Gonser and E. M. Sherwood. Although the authors call columbium—"niobium," this volume is a good reference on the metal. It contains papers from the symposium on columbium conducted by the Electrochemical Society in 1958. Papers include sources, economics, extractive metallurgy, use in reactors, recent metallurgical processes, analysis, uses, and physical properties. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N.Y. Illustrated in 120pp. $7.

Geology of the Great Lakes, by Jack L. Hough. Details the technical history of the various stages of the formation of the Great Lakes. Interesting, well illustrated. Published by University of Illinois Press, Urbana, Ill. 296pp. Price $8.50.

Transactions of the Canadian Institute of Mining & Metallurgy and the Mining Society of Nova Scotia, 1957. Contains more than sixty papers presented at the 1957 annual meeting held at Vancouver, B.C. May be obtained from CIMM, 906 Drummond Building, Montreal, Ontario, Canada. Illustrated in 398pp. Price unlisted.

Swedish Mineral Dressing Mills, compiled by Ernst Rothelius for the International Mineral Dressing Congress, Stockholm, 1957. Contains short descriptions and flowsheets on 24 operations in Sweden. Well done. Published by the Congress, Nachstromsgatan 1III, Stockholm C, Sweden. Price 6.25.

Effect of Surface on the Behavior of Metals. Lectures delivered at the Institution of Metallurgists Refresher Course, 1957. Covers methods of preparation and examination of surfaces, the influence of surface treatments on the chemical behavior of metals, relationship between surface condition, friction and wear, and the influence of surface on the physical properties of metals. Published by the Institute of Metallurgists, London. May be obtained through Philosophical Library, Inc., 15 East 40th St., New York 16, N.Y. Illustrated in 100 pp. Price $10.

Introduction to Historical Geology, 2nd ed., by Raymond C. Moore. Completely revised textbook treats the history of the earth. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. Well illustrated and interesting reading. 638pp. Price $7.95.

Compact Heat Exchangers, by W. M. Kays and A. L. London. Comprehensive treatment of compact heat transfer surfaces in use today. For the designer rather than the user. Published by McGraw-Hill Book Company, Inc. (address above). 156pp. Price $6.00.

BOOKS presented on this page may be obtained by writing directly to the publisher mentioned in each individual item. E&MJ does not offer for sale any of this literature unless noted.

Additions to the Manual on Rock Blasting as prepared and published by Atlas Copco. These chapters are now available—

8:30—*Rock Drilling Methods and Their Field of Use,* by L. Janelid, 31 pp.

8:51—*Bench Blasting on Construction Projects in Sweden,* by T. Bjarnekull. 20pp.

20:02—*Loading in Swedish Underground Mines,* by C. B. Berglund and C. Westlund. 42pp.

May be purchased from Atlas Copco Eastern, Inc., 610 Industrial Ave., Paramus, New Jersey. Price not stated.

Reports and Bulletins

Report of Investigation No. 37. Mineral Resources of the Colorado River Industrial Development Association Area, by J. W. Dietrich and J. T. Lonsdale. Published by the Bureau of Economic Geology, University of Texas, Austin 12, Tex. Maps, plates and 79pp.

Bulletin 61. Lexicon of New Mexico Geologic Names: Precambrian through Paleozoic, by H. L. Jicha, Jr., and Christinia Lochman-Balk. Published by State Bureau of Mines & Mineral Resources, Socorro, N.M. 137pp.

County Report No. 3. Geology and Mineral Resources of Ada and Canyon Counties, by C. N. Savage. Published by State of Idaho Bureau of Mines and Geology, Moscow, Idaho. Maps, plates and 94pp.

Bulletin 46. Topical Study of the Lead-Zinc Gossans, by William C. Kelley. Published by the State Bureau of Mines & Resources, Socorro, N.M. Plates, maps and 77pp.

Bulletin 116. Gibbsite-Rich Soils of the Hawaiian Islands, by G. Donald Sherman. Published by the Hawaii Agricultural Experiment Station, University of Hawaii, Honolulu. 22pp.

Special Report 54. Age determination of some granite rocks in California by the potassium-argon method, by G. H. Curtis, J. F. Evernden and J. Lipson. Published by Division of Mines, Ferry Building, San Francisco 11, Calif. 16pp. Price 50c.

Information Circular 13. Iron Deposits of Montana, by Victor C. DeMunck. Published by the Montana Bureau of Mines and Geology, Butte, Mont. 54pp.

Bulletin 74. Geology and Mineral Resources of the Lynchburg Quadrangle, Virginia, by W. R. Brown. Published by Virginia Division of Mineral Resources, Charlottesville, Va. Maps, plates and 96pp.

Special Report 51. Economic Geology of the Darwin Quadrangle, Inyo County, Calif., by W. E. Hall and E. M. Mackevett. Published by Division of Mines, Ferry Building, San Francisco 11, Calif. Maps, illustrations and 73pp. Price $2.50.

Canadian Asbestos Industry, by E. J. Bonkoff. Structure, production, markets, exports, companies and future prospects of Canadian asbestos industry. Published by General Research Associates, 4 Richmond Street East, Toronto, Ontario. 41pp. Chart, map and 9 tables. Price $15.50.

Bulletin No. 2 Tantalum/Columbium Minerals in Malaya, by H. W. Hocklin. Published by the Department of Mines, Kuala Lumpur, Federation of Malaya. Plates and 16pp. Price $2.50 (Malayan).

Council Paper No. 21. Geological Survey and Annual Report, 1957. Published by Legislative Council of Fiji, Suva, Fiji. 18pp. Price 2/.

• Professional Papers and Bulletins from U.S. Geological Survey, as listed below, may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Remittance should be made by money order.

Professional Paper No. 293. Quaternary and Engineering Geology in the Central Part of the Alaska Range, by Clyde Wahrhaftig and Robert F. Black. Part A—Quaternary geology of the Nenana River valley and adjacent parts of the Alaska Range. Part B—Engineering geology along part of the Alaska R.R. Maps, illustrations and 116 pp. Price unlisted.

Professional Paper No. 294-I. Structure and Igneous Geology of the La Sal Mountains, Utah, by Charles B. Hunt. Maps, illustrations and 55pp. Price unlisted.

Bulletin 1046-I. Geology of Majuba Hill, Pershing County, Nev., by Albert F. Trites, Jr. and Ralph H. Thurston. Maps and 20pp. Price unlisted.

Bulletin 1052-D. Magnetic-Doublet Theory in the Analysis of Total-Intensity Anomalies, by Roland G. Henderson and Isidore Zietz. 27pp. Price 15c.

Sets a fast pace in small space...

The JOHN DEERE *Diesel* Crawler-Loader

Compact and highly maneuverable, this new Diesel Crawler-Loader is tailor-made for getting top production out of tight spots.

Fast cycle time is built right into the bucket linkage. When bucket is dumped from the full-height position, it returns to the ideal 9-degree digging angle *by use of the boom control only.* Leveling out a spot? Again, use of the boom control is all that's required. Operating speed takes another jump with the John Deere clutch-type direction reverser.

There's a 35-degree roll-back for plenty of pry-out action, and the self-leveling linkage means you get those heaped loads into the truck. Maximum dumping height is 10 feet. Bucket capacity, heaped is 7/8 yard.

Ask your John Deere Industrial Dealer for a demonstration.

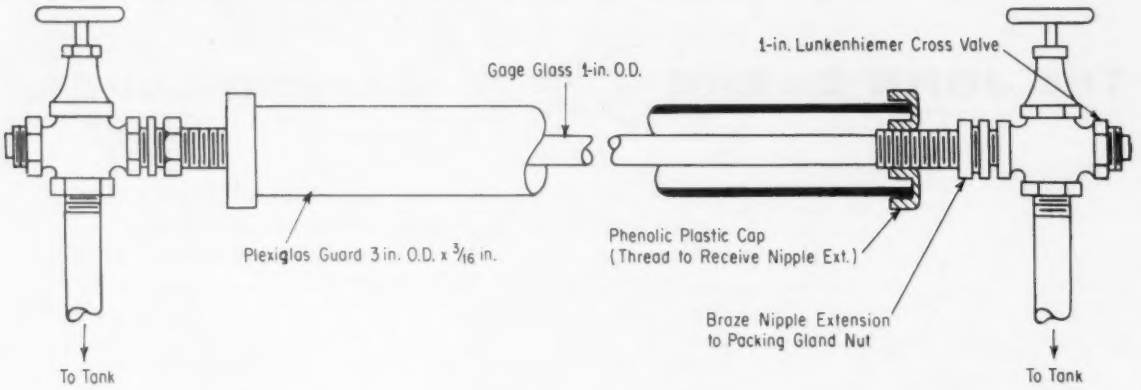
Write Dept. 528 for additional information on John Deere Diesel Crawler-Loaders or these mine and quarry units:

- **John Deere "440" Crawler-Bulldozers**
- **John Deere "840" Diesel Wheel Tractors**
- **Hancock "Piggyback" Elevating Scrapers for removing overburden, transporting crushed rock.**

JOHN DEERE Industrial Tractors and Equipment

JOHN DEERE INDUSTRIAL DIVISION · MOLINE, ILLINOIS

OPERATING IDEAS



Plastic Sheath Reduces Breakage of Ion Exchange Glass Tubing

AN ACRYLIC PLASTIC GUARD has reduced the breakage of long gage glass on wet milling and ion exchange process equipment.

K. N. Banthin, mining engineer, Broadview, Ill., says that the guard consists of a three-in. length of threaded pipe nipple brazed to packing gland nut for each end of gage glass, a length of acrylic plastic tubing, and two machined phenolic plastic blocks.

Here's how the gage glass and guard are installed.

1. Assemble the phenolic plastic block on the upper (right) gage nipple extension until it rests against the packing gland nut.

2. Slip the assembled unit over gage glass and insert gage glass with packing follower and packing ring.

3. Insert gage glass into upper gage glass gland and move upward into valve.

4. Assemble the phenolic plastic block on the lower (left) gage glass nipple extension until it rests against the packing gland nut.

5. Slip acrylic plastic tube over the gage glass and slip the No. 4 unit up and over the gage glass.

6. Move gage glass and guard into alignment, install packing follower and packing ring, lower gage glass into bottoming position in lower gage glass gland.

7. Secure gage glass in place.

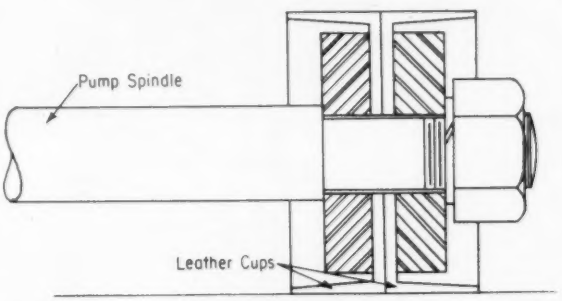
8. Turn plastic blocks on upper and lower nipple extensions until they contact the plastic tube and hold it firmly in place.

Pump Shut-Off Saves Diamond Bit

BURNT BITS used in shallow diamond drilling become a thing of the past when pliable leather cups are attached to small air pump pistons. The cups jam the direct-acting pump to a halt as soon as the discharge is shut off.

According to H. Baumgurtel, Zinc Corp. Ltd., Broken Hill, Australia, when the cups are not attached, and if the drill rods are blocked, the pump will usually continue to work and circulate the water within itself. This gives the driller the false impression that water is still being supplied to the diamond bit—it may then be seriously damaged.

Baumgurtel also said that recent tests showed neoprene cups are even better—they don't harden when they dry out.



Cut-Down Cat Mucks in Low Areas

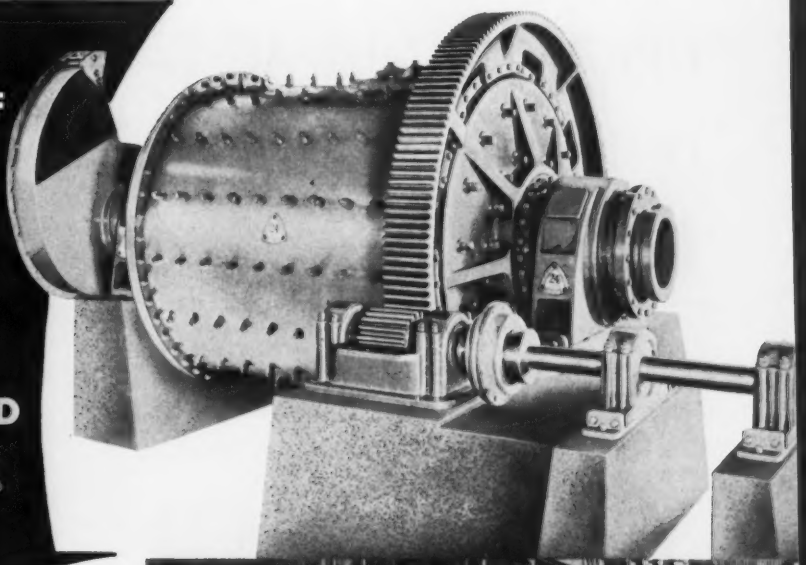
SPECIALLY-MODIFIED, low-operating height, front-end loaders have helped solve the problem of gathering muck in thin sections of several underground mines in the Ambrosia Lake uranium district of New Mexico.

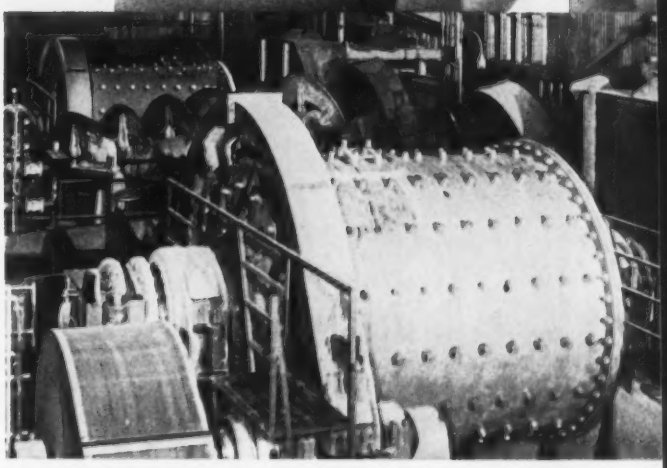
These modified 1-yd Caterpillar No. 933 Traxcavators are a prodigy of the local dealer, R. L. Harrison Co., Inc. in Alburquerque. Twenty nine such devices are now in operation.

While maintaining the operating level of the standard machine, each modified Traxcavator's overall height is cut to 70 in. as compared to 75⅜ in. without exhaust stack or 93⅜ in. with exhaust stack.

Beginning with a standard No. 933, the following changes are made at Harrison's shop: First, the lifting mechanism is modified by both shortening the bellcrank height to limit its upward travel and by shortening the differential and link arms to obtain maximum dumping ability at the new operating height. These changes still permit the bucket to be raised to nearly normal maximum height should the 933 be needed for such out-of-mine uses as truck or railroad car loading. Next, the fuel tank is moved downward 11 in. and its top re-shaped. And finally, an exhaust scrubber is installed.

SPECIFICATIONS OF DENVER Steel Head MILLS Establish NEW TREND in GRINDING MILL SELECTION





All Big DENVER Ball Mills Have These Distinctive Design and Construction Features Important to the Productivity and Profitability of Your Grinding Operation:

- **Cast Steel Heads** many times stronger than cast iron. Eliminates risk of head breakage.
- **Ball and Socket Trunnion Bearings** are sealed to exclude dirt and dust.
- **Continuous Lubrication** from oil reservoir in trunnion base.
- **Hydraulic Lift Mechanism** takes load off trunnion bearings for easy starting. (optional)
- **Adjusting Sole Plate** under trunnion bearing base is bolted to one-piece pinion shaft bearing housing—assures perfect, permanent alignment of gear and pinion—for trouble-free operation.
- **Self Aligning, Anti-friction Pinion Bearings** are in cartridge type carriers and mounted in a one-piece housing.
- **Greater Capacity**—both diameter and length are measured inside liners.
- **Choice of 15 Types of Mill Discharges** to meet individual grinding requirements.

For Complete Information Write for Bulletin B2-B20

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DENVER GRINDING TEST SERVICE

DENVER'S completely equipped testing lab is backed by over 30 years of practical test and field experience. Complete facilities for batch or pilot tests, open and closed circuit grinding, wet or dry, 2-stage systems with mechanical cyclone, screen or air classification. Determine grinding characteristics, mill capacities, circulating load, size of accessory equipment, power requirements. Preliminary examinations made without charge.

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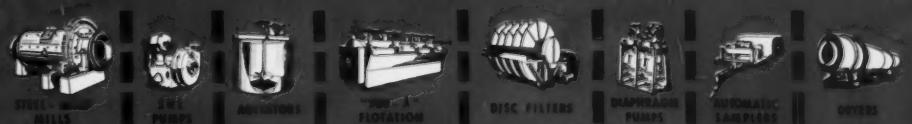
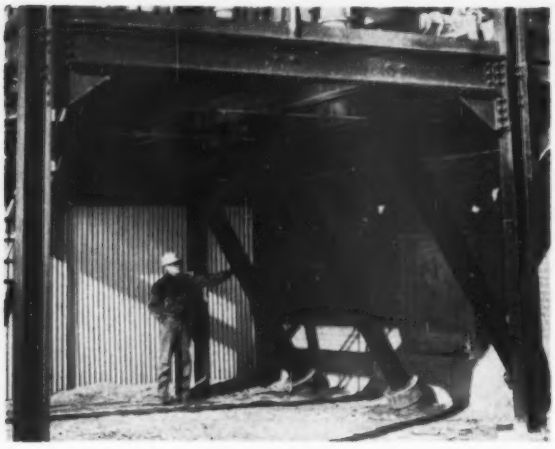


OPERATING IDEAS *(Continued)*

Pilot Hole Eases Winzing In Fill

USING A WATER-JETTED PILOT HOLE, a cheaper and safer method of winzing through sand-fill from stope face to level has been developed at Zinc Corp. Ltd., Broken Hill, Australia. The company says it does away with the usual tripods and buckets and requires less set-up time, less materials handling time, and reduces the danger of falling debris.

First, the crew makes a pilot hole up from the level using water and compressed air to jet through the sand with a ½-in. pipe. The resulting hole is 6 in. in dia at the level and narrows to 2 in. at the stope floor 50 ft above. The hole is then enlarged from the top end with the water jet and concurrently cased with 3-ft lengths of 11-in. dia sheet metal pipe. Finally, the winze is enlarged to full size and deepened by shoveling into the cased hole. At the same time, plank lining is hung from timber bearers and extended by cleating more plank on the bottom.



No Dust Clog With Plastic Pipe

LARGE AMOUNTS of escaping limestone dust caused a serious air pollution problem at Allied Chemical's Solvay Process Div., Syracuse, N. Y.

Though a recently-installed air filter system eliminated the main problem, company engineers found a bottleneck. Dust was clinging to the inner walls of three 18-ft lengths of 8-in. steel pipe that carried the dust from the collecting bins to a conveyor inside the plant building. The dust bridged in the pipe and eventually filled up the hopper.

Staffmen then installed 8-in. smooth-walled polyethylene plastic pipe. This did the trick and the filter system has since been operating continuously and reliably.

How To Pick Correct Diesel Fuel

A HIGH-RPM DIESEL ENGINE can be more efficiently maintained if it uses a fuel having characteristics suitable for the job at hand. The accompanying chart, based on data prepared by Detroit Diesel Engine Div., General Motors Corp., and appearing in the January 1959 edition of the LeTourneau-Westinghouse *Co-Operator*, point out the desired fuel specifications for varied operating conditions.

Co-Operator also felt that engine life should be an important consideration when selecting fuels. "The money saved on fuel costs with low grade fuels may be offset by additional maintenance, more frequent overhauls and the use of high priced higher detergent lubricating oils required when low grade fuels are used. If the engine owner finds that for his application he is able to get a savings with low grade fuels, then by all means he should do so."

In areas where high grade fuels are simply very hard to get, specialized high detergency lubricating oils should be used to help counteract sludge formation and lube oil contamination.

Type of Engine Application	Ambient Air Temperature	Distillation 90% Boiling Point (Max.)	Distillation Final Boiling Point (Max.)	Cetane Number (Min.)	Sulfur Content (Max.)
Wide variation in load and speed, considerable idling.	Above −20° F	550° F	575° F	45	0.25%
	Above 0° F	575° F	625° F	45	0.50%
	Above +40° F	575° F	625° F	45	0.50%
	Above +80° F	625° F	675° F	40	0.50%
Intermediate load and speed, minimum idling.	Above −20° F	550° F	575° F	45	0.25%
	Above 0° F	575° F	625° F	45	0.50%
	Above +40° F	625° F	675° F	40	0.50%
	Above +80° F	625° F	675° F	40	0.50%
Heavy load and high speed, minimum idling.	Above −20° F	575° F	625° F	45	0.50%
	Above 0° F	625° F	675° F	40	0.50%
	Above +40° F	625° F	675° F	40	0.50%
	Above +80° F	675° F	725° F	40	1.00%

B.F.Goodrich

B.F.Goodrich tires give coal hauler 50% more service than any other make

TWIN SEAM MINING CO. of Tuscaloosa, Ala. operates 17 dump trucks to haul coal over dirt roads that are mountainous and winding. Payloads average 15 tons. Tire blowouts from impacts against rocks were a problem for Twin Seam. Then they switched to B.F.Goodrich Rock Logger tires. Result: no road delays caused by punctures or blowouts, and 50% more service than from other makes. Rock Logger tires are retreaded after 100,000 miles for an additional 50,000 or more miles!

B.F.Goodrich builds the Rock Logger with a specially compounded tread that resists rock cuts and bruises. Under the tread is the B.F.Goodrich FLEX-RITE NYLON cord body. FLEX-RITE NYLON withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder this B.F.Goodrich cord construction outwears even extra-thick treads, can still be retreaded.

Take a tip from Louis Bosch, head mechanic at Twin Seam, who says: "Rock Logger tires give excellent traction—and can really take a beating!" See your nearby B.F.Goodrich Smileage dealer today. He's listed under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Enter the B.F.Goodrich Truck Tire Mileage Contest. You can win a Thunderbird or Corvette or one of 310 other prizes. See your B.F.Goodrich dealer for entry blanks.

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

Smileage!

B.F.Goodrich *truck tires*

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WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Exploration

Low frequency electromagnetic induction method and apparatus for use in detection of a hidden massive sulphide ore body and determination of its approximate size and azimuthal location relative to a drill hole. Alternating current flow frequency is maintained so low that any voltage induced in the detector coil will be due solely to the presence of massive or interconnected sulphides and not to the presence of a better conducting section of rock formation. A. A. Brant and A. W. Love, assigned to Newmont Mining Corp. No. 2,874,348.

Metal and Mineral Processing

In the roasting of pyrites to produce elemental sulphur, finely-ground ore is fed to a fluidized bed of inert material, e. g., crushed fire-brick, in a confined space. Gas pressure is maintained sufficiently high to move the cinder out of the bed along with the gas, yet not high enough to cause the ground pyrites to be blown out. D. K. Eads and G. P. Giusti, assigned to Texas Gulf Sulphur Co. No. 2,872,294.

Improved leaching of nickel and cobalt content from ores or ore fractions containing one or both of those metals. Ore is mixed with aqueous H_2SO_4 containing $Al_2(SO_4)_3$, heated to dissolve the desired metals, cooled, and aged to solubilize the $Al_2(SO_4)_3$. Leach liquor is stripped and recycled, and the nickel and cobalt sulphides recovered. J. G. Morrow, assigned to Freeport Sulphur Co. No. 2,872,306.

Liquid-liquid extraction of uranium values from the leached zone and phosphate matrix layers of the Florida pebble phosphate rock deposits. W. R. Bowen, assigned to U.S. AEC. No. 2,873,166.

Simplified, direct and continuous reduction of iron oxide ores, such as magnetite and beneficiated taconite, to produce a product suitable for use in steelmaking, using gas as fuel. Instead of complete reduction, if desired the ore may be partially reduced and the resulting "synthetic scrap" stored for use in emergencies. R. D. Pike, held by K. B. Ray and Stamford Trust Co., as executors. No. 2,873,183.

Process for stabilizing against oxidation and excessive temperature increase in metallic iron which has been obtained by direct reduction of iron ore. Precooled, compacted iron is immersed in a high boiling mineral oil under conditions which restrict the rate of liberation of hydrogen. E. E. Fisher, assigned to Gulf Oil Corp. No. 2,874,037.

Mr. North is patent consultant Washington, D.C.

In a method for extraction of scandium from thorveitite ores of Norway and Madagascar, the ore is ground to pass 200 mesh and mixed with calcined petroleum coke. Mixture is placed in a refractory boat and heated to 950 deg C in a refractory tube, and dry chlorine is passed over the mixture to produce pure anhydrous scandium chloride. Compound is then treated with ammonia to precipitate scandium oxide. Yttrium chloride remains at the hottest end of the apparatus. E. J. B. Pruvot, assigned to Pechiney Compagnie de Produits Chimiques et Electrometallurgiques. No. 2,874,039.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D.C.

Hydrometallurgical process for extracting zinc from either high-grade or low-grade soluble silicate zinc ores. Ore is leached with H_2SO_4, and the resulting reaction slurry mixed with a sufficient quantity of $Al_2(SO_4)_3$ to coagulate the silica. Coagulated silica is then filtered off, and the solution electrolyzed as usual. Removal of the interfering silica ions facilitates the electrolysis step. H. L. Radino, 50% assigned to Companhia Mercantil e Industrial Inga. No. 2,874,-041.

Procedure for efficiently recovering asbestos fiber from weathered dump tailings, such as those of Canada, containing 1-8% short chrysotile fiber the bulk of which is in the fluffed state. Tailing is mixed with water and air and treated progressively in primary and secondary drag classifiers and then over a shaking table. M. C. Pharo, assigned to Johnson's Co. Ltd. No. 2,874,838.

In the recovery of uranium values from low-grade Colorado Plateau ores or the like, the ore is pugged with H_2SO_4 to solubilize the uranium as uranyl sulphate without formation of a separate liquid phase. Uranyl sulphate is converted to uranyl nitrate by reaction with NH_4NO_3. Uranyl nitrate is extracted from the ore by leaching with tributyl phosphate. P. Galvanek, Jr., assigned to U.S. AEC. No. 2,875,023.

In a method for recovering iron from ilmenite or other unreduced titaniferous iron ores, the ore is leached with HCl at a temperature of at least 175 deg C and at subatmospheric pressure, and thereafter mechanically separating the solubilized iron component. J. H. Bachmann, assigned to Columbia-Southern Chemical Corp. No. 2,875,039.

Method for rendering titaniferous ores, especially Florida or inland titaniferous sands, more amenable to chemical processing. Ore is caustic washed with an aqueous solution of an alkali metal hydroxide, for example NaOH, followed by water washing. Resulting sands may be readily handled in the settling tanks. W. H. Daiger, assigned to E. I. du Pont de Nemours & Co. No. 2,875,107.

LETTERS

U.S. Gold Stocks

May I refer to the U.S. gold stock graph on p 113 in your 90th annual survey and outlook? (February issue). It is my belief, and I shall be glad to stand corrected, that in Committee testimony it has been stated that foreign interests have a call on a large part of this gold stock, the amount being in the billions.

If such is true, would it not be proper to show this obligation in the U.S. gold stock graph? (Any corporation would be required to do so in a financial statement). Further, if this is the case, is not the graph highly misleading?

I. W. Hoeffler
San Francisco

● The graph is not misleading for this reason—we quote the Federal Reserve *Bulletin* for February, p 228—"Gold held under earmark at the Federal Reserve banks for foreign or international accounts amounted to $8,603.3-million [$8.6-billion in U.S. mathematics] on Jan. 31, 1959. Gold under earmark is not included in the gold stock of the U.S." The Federal Reserve *Bulletin* is available at most large libraries.

Thus it is clear that the U.S. gold stock chart is not misleading, but on the contrary gives an accurate picture and shows the actual U.S. gold stock at the end of 1958—about $20.6-billion.

The Editor

The Wild Wa's

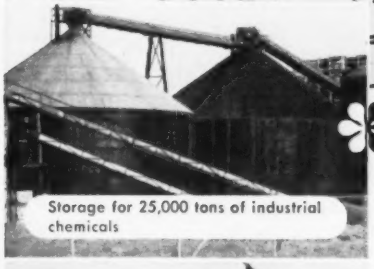
THE ARTICLE in the July 1958 issue of the *E&MJ*, *The Wild Wa's* by Fred Searles, Jr., recounting an examination made by him in 1921 in the area of Burma and China occupied by the Wa tribe, states "it is improbable that any progress has been made since 1921 in development of the mines mentioned." Mr. Searles is correct, for the picture has changed little since that time.

Burma was granted her independence from Britain on Jan. 4, 1948. Since that time Burma and China have agreed on a definite boundary which runs generally in favor of the former Chinese claim. However, the boundary still runs through the land occupied by the Wa

(Continued on p. 196)

West End "fills the order"...

TO PLANT 9/11 2:35 P M
HAZCO URGENTLY NEEDS EXTRA
HOPPER CAR SODA ASH FROM TANK
6 SHIPPED TODAY. ADVISE. END
TO OFFICE
CAN DO. WILL PULL CAR FROM
STORAGE SPUR AND SHIP TODAY.
CAR NO. NAHX 31078.


Storage for 25,000 tons of industrial chemicals

Immediate shipment in leased hopper cars

Vast natural source of raw material

Meeting service requirements to the letter and producing superior soda ash of consistently accurate particle size and chemical analysis are the essentials to which the West End organization is uniquely geared. A system of rapid communications linking our sales office in Oakland with our production, technical and shipping departments at the desert plant site permits each department head to have a complete understanding of the customer's individual requirements and to make firm commitments or provide the desired information promptly.

WEST END SODA ASH

WEST END CHEMICAL COMPANY

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

DIVISION OF Stauffer CHEMICAL COMPANY

ABOVE 800 FT in the Peruvian Andes, Acari iron mines will commence 5,000 tpd shipments of iron ore via a company-built 56-km highway to the new port of San Juan.

Acari Prepares for July Iron Ore Startup

ACARI IRON ORE MINE, 525 km south of Lima, Peru, in the Andean foothills, is scheduled to begin production in early July with shipments of 5,000 tpd magnetite iron ore averaging 65% iron (*E&MJ*-November 1957, p 214). Work is progressing in three important areas: at the mine site, facilities are being established for crusher and other buildings; a heavy-duty highway is under construction from Acari to the port of San Jaun; and a pier is being built to receive truck shipments from the mine.

Acari, owned by Pan American Commodities, S. A., Lima, and operated by its subsidiary Compañia Explotadora de Hierro de Acari, is above 800 meters elevation.

So far 12 veins of magnetite ore have been located on the 25,000 hectare claim with one vein estimated at 30-million tons. A site for an ore crusher with a capacity of 800 tons per hour has been located close to the mine and preliminary work on this phase of the project has been started. A 1500-meter long airfield has already been completed, and is capable of landing DC-3s.

Construction work at the mine is also showing good progress with Wells Overseas Ltd., of Toronto, Ont., Canada, under the direction of project manager Norman S. McHarg, preparing the mine for operation and supervising construction of the haulage system from mine to port.

While work continues on the mine camp, geological investigations are being carried out in preparation for strip mining and to block out other nearby orebodies for future development.

Crushed and sized ore will be transported by Kenworth trucks and trailers to the port of San Juan for shipment. The trailers will be built in Peru and will constitute the largest fabrication of this type yet undertaken there. Ore will be shipped exclusively by road transport.

Due to steep gradients of the foothills, plans for a 38 km railroad from Acari to the port of Lomas had to be abandoned. A 56 km heavy-duty highway to connect the mine with the port of San Juan is under construction, with heavy excavation under way both in and out of the Jaguay gorge. Underpasses have been started at the Pan American, Marcona and San Nicolas roads. Concrete is now finished at the Pan American and the section is to be reopened to traffic soon. Approximately 1 km of the Pan American Highway is being reconstructed to accommodate the Acari road. In late February about 20 km of the highway had been finished and the remainder almost completely graded through to San Juan.

The Acari-San Juan highway is nine meters wide, with a one meter berm on each side to provide adequate clearance for the heavy-duty trucks traveling to and from the port. Curves on the road have been well banked, a factor of great importance for the heavy loads to be carried on the highway. Sand traps will be constructed at intervals—in event of a brake failure the truck driver will be able to divert his vehicle into a sand trap and bring it to a safe halt without endangering other traffic on the highway.

The port project is being directed by Frederick Snare Corp. of New York and Lima. The pier is of concrete deck construction supported by an H-pile base, with a total length of 667 meters, 120 meters of rock fill approach, 367 meters of pier approach and 180 meters of actual loading pier. The pier approach will carry the ore conveyor and a one lane road for heavy trucks. The loading pier starts at a depth of 40 ft of water and is approximately 65 ft wide.

The pier is designed to accommodate any ship that can pass the Panama Canal, and provides loading equipment to handle 1500 tons of crushed ore per hour by means of a conveyor and a self trimming loading tower. Trucks arriving from the mine will discharge the ore into a hopper from which conveyors will stack the ore onto separate storage piles according to quality and size.

Ore storage will handle some 150,000 tons. The storage and ship loading system has been engineered and is being supplied by Hewitt-Robins Inc., of New York.

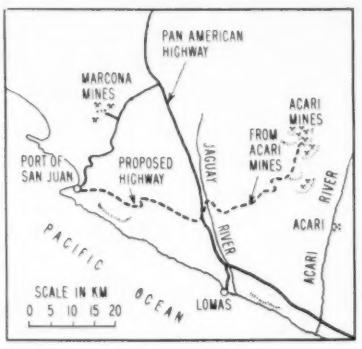
All oil tanks, administration buildings and warehousing have already been erected in the pier area, and a power station of 1125 kw is under construction to provide power for the loading facilities. Electric power will be generated by three Deutz diesel generators of 375 kw each.

Arthur M. Henricksen is the project manager for the Acari pier and loading facilities construction at San Juan.

Pan American owns another iron orebody in the north of Peru and two iron ore deposits south of Lima, including Acari, as well as two copper and two gold deposits.

All these are results of an exploration program started in 1950. The prospecting has been organized on a scientific basis, with all the necessary auxiliary instrumentation. During the exploration campaign several magnetometric and photographic surveys were flown by the Aero Service Corp. of Philadelphia.

Acari ore is a hard lump open hearth high-iron material and only a small quantity of blast furnace ore will be available as a by-product of the mining and grading operation.



A NEW NEIGHBOR for Marcona, the Utah Construction-Cyprus Mines iron property south of Lima, is the new Acari, due to start production in July.

Waiting for the Run to Taconite Harbor. This is a portion of Erie Mining Company's vast operation at Hoyt Lakes, Minn. Here taconite is mined, crushed, powdered, and rolled into tiny balls. Each year millions of tons of these pellets are shipped by rail to Taconite Harbor on Lake Superior, 74 miles away. At the port they begin the second stage of their journey to various steel mills.

That huge machine you see at work is the pellet-stacker, which dumps the loads from the agglomerating plant into a storage area. Rigged throughout with Bethlehem wire rope and bridge strand, it employs cables ranging in size to 3¼ in. This mechanical giant is a tough taskmaster, but the Bethlehem ropes have been equal in every way to the rugged work which has been assigned to them.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem Wire Rope

BETHLEHEM STEEL

India's Uranium Metal Plant Goes Onstream

TO A BOMBAY PLANT goes the honor of producing the first pure ton of uranium metal anywhere in Asia. This $462,000 plant, designed and constructed by the Indian Rare Earths (Pvt.) Ltd., for the Indian Department of Atomic Energy, has been set up at the AEC establishment at Trombay, near Bombay. The plant produced the first ton of uranium at the end of January.

According to its officials, the following process explanations are made available: The monazite sands of the Travancore (south India) coasts contain up to 0.28% U_3O_8. The rare earths and the thorium are separated in the two plants of Indian Rare Earths (Pvt.) Ltd. at Alwaye (Kerala state) and Trombay respectively. The uranium is recovered as a fluoride. This forms the raw material for the new uranium plant, which has been modified in the first stage of processing because of the unusual chemical composition of the starting material.

In the new plant, however, it has been made possible to treat other uraniferous concentrates like sodium diuranate, uranium oxide concentrates, etc. The Trombay unit has been designed as a pilot plant with provisions to expand output to produce sufficient replacement uranium metal for a 250 mw nuclear reactor. Meanwhile, the new unit will supply initial charges of uranium for the new zero energy reactor (Zerlina) at Trombay and for the now-building Canada-India reactor.

Inside the new plant the crude fluoride of uranium is agitated with a solution of sodium carbonate and sodium bicarbonate with the addition of a hydrogen peroxide. The uranium is converted into a soluble carbonate complex. The solution is filtered and the filtrate is treated with sodium hydroxide to precipitate the uranium as sodium diuranate. The sodium diuranate then is dissolved in nitric acid and filtered. This filtrate is allowed to age and again filtered to remove as much silica as possible. The uranyl nitrate solution is purified by solvent extraction using a 30 to 40% volume of T.B.P.-kerosene mixture. The solvent extraction consists of 20 ft high columns. Raschig rings are used as packing for the extraction column.

The uranium nitrate solution is pumped into a steam jacketted stainless steel tank, which has a specially-designed agitator for precipitating ammonium diuranate of optimum particle size and filtration characteristics. A mixture of air and ammonia is passed through the agitated solution. The ammonium diuranate is filtered and the cake, after washing with water and alcohol, is calcined in a muffle furnace of 350 to 400 deg C.

The uranium trioxide obtained is reduced to uranium dioxide in a stream of cracked ammonia gas in a continuous tubular furnace. The temperature of reduction is 600 deg C. The uranium oxide produced in this furnace is a fine free-flowing brown powder which is transferred then to a fluorination furnace. The fluorination is affected by the action of anhydrous hydrogen fluoride at 550 deg C. The special features of this furnace include carbon-dioxide seals at the two ends of the furnace to prevent leakage of hydrogen fluoride gas.

The anhydrous uranium tetrafluoride is stored in airtight aluminum cans in an atmosphere of carbon dioxide.

The fluoride is mixed with calcium granules in a wobbler type mixer, the amount of calcium used being up to 50% in excess of the stoichiometric requirement. The reduction of uranium tetrafluoride with calcium is carried out in a closed vessel lined with dry calcium fluoride. The products of reaction are allowed to cool for 24 hours. The standard ingot ton weighs 40 to 45 kg.

5-MILLION TONS of over burden were removed by Isbell Construction Co. before copper production began in March. (Photos were taken by E&MJ in early February).

$15-MILLION mill was built by Stearns-Roger. Structure is seven stories high, will handle 10,000 tpd output from the mine, located 25 miles south of Tucson.

Duval Sulphur Starts Esperanza Open Pit

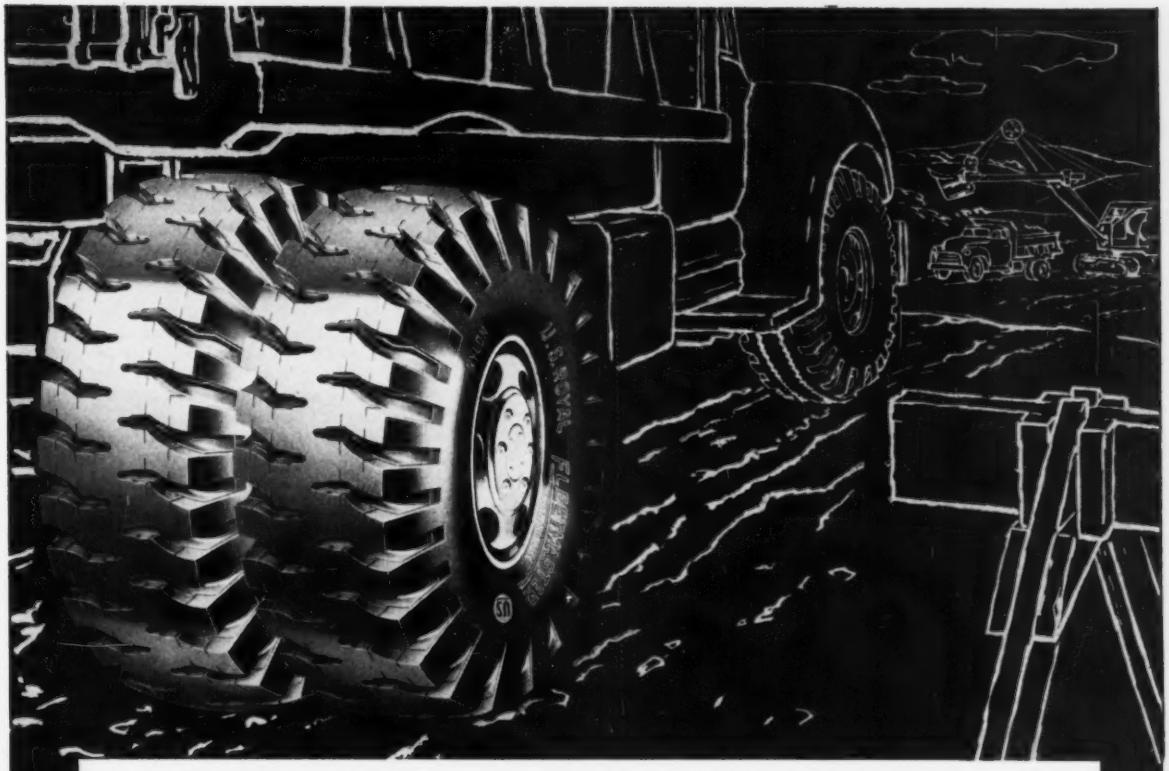
DUVAL SULPHUR & POTASH CO. started production from the Esperanza mine and mill in early March. The $20-million development is 25 miles south of Tucson, Ariz. in the Twin Buttes district.

Production of 10,000-tpd copper is expected from the open pit operation in a few weeks. In the past year, 350 men from Stearns-Roger Manufacturing Co. and Isbell Construction Co. have pushed the mill to completion and removed some 5-million tons of overburden. The mine and mill work force will remain roughly at 350 men, according to George E. Atwood, resident manager.

Duval estimates the orebody, based on test drilling performed since 1957, at approximately 49-million tons of 0.75% Cu.

The mill, constructed for about $15-million, includes primary and secondary crushing equipment (left, in above photo). The concentrator building (right) contains grinding, flotation and filter departments and a molybdenite recovery plant.

NEW STRENGTH, NEW DRIVE CUT COSTLY DOWNTIME



New Cross-Lug U. S. Royal Fleetmaster Dual-Purpose-Nylon beats the tire hazards that can wreck tight schedules!

Contractors all over the country are finding out that using this great new U. S. Royal Fleetmaster Dual-Purpose reduces job delays due to tires. Its 52% stronger body, of exclusive Double-Strength Nylon cord, defies impacts that ruin ordinary tires. Its big, deep cross-lugs dig in for 35% greater traction, prevent spinning wheels, bogged-down trucks, broken schedules. See it for yourself. Call your U. S. Royal Dealer right now. And make sure to specify "U.S. Royal" on the next new equipment you buy! Available in tubed or tubeless construction.

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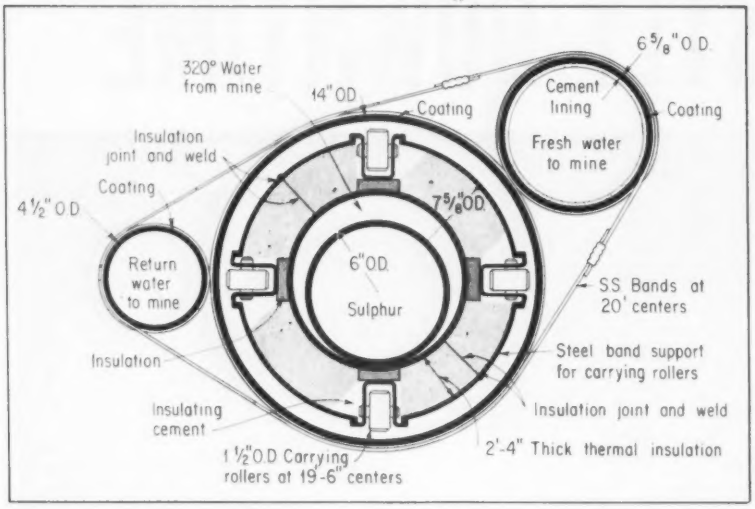
Freeport Sulphur Outlines Submarine Pipeline



FIVE LINES, uniquely combined to handle molten sulphur, hot water, insulation and two separate water lines, will transport 30-deg sulphur seven miles from Grande Isle Mine to the plant onshore under Gulf of Mexico waters.

FREEPORT SULPHUR CO. is making good progress with preliminary plans for a 7-mile long pumping installation that will pipe molten sulphur from their offshore sulphur mine in the Gulf of Mexico to a liquid-tank-barge loading wharf inshore at Grande Isle, La., (*E&MJ*, p 9, March 1959).

The Grande Isle mine is located in 50 ft of water, and barge shipment from the mine would involve difficulties due to potential rough seas and additional cost of a loading wharf.

Under the preliminary plan, outlined by R. H. Feierabend, assistant vice president of Freeport Sulphur Co., at the annual meeting of the AIME in San Francisco, Feb. 15 to 19, 1959, the pipeline will be buried 5 ft below the bottom of the gulf and will consist of three concentric pipes: a 14-in. OD protective casing, a 7⅝-in. OD hot water jacket line, and a 6-in. OD sulphur line. Liquid sulphur will be pumped through the 6-in. pipe and hot water through the annulus between it and the 7⅝-in. pipe. The annulus between the 7⅝-in. pipe and the 14-in pipe will provide space for 2¼-in. of thermal insulation and a small air gap. Weight of the 6-in. and 7⅝-in. pipes are to be carried on ball bearing rollers spaced every 19 ft 6 in. along the line. The rollers will afford a means of pushing or pulling the inner lines through the 7-mile long, 14-in. casing and will allow frictionless differential movement between the two sets of line.

Entrance temperature of both the sulphur and water at the mine will be 320 deg F and the exit temperature on the shore end will be 280 deg F. If the sulphur entered the pipe line hotter than 320 deg F, viscosity would become too great, and if the sulphur were allowed to drop too far below the 280 deg level it would freeze in the line.

While efficiency of the insulation and the air gap which surrounds the 7⅝-in. pipe is high, heat loss is still expected to be appreciable. With an ambient soil temperature of 75 deg F, the 14-in. casing will reach 110 deg F and heat loss to the wet soil will amount to 90 Btu per linear foot, or about 75-million Btu per day.

Maximum capacity for the pipeline is expected to be 4,500 long tons of sulphur per day or 470 gpm, which will require a pump pressure of 900 psig on the mine end. At that rate of sulphur flow, only 15 gpm of 325 deg F water would be required to assist in overcoming heat loss. At 2,500 tons per day or 250 gpm sulphur flow, 25 gpm of water would be needed. For starting up and at extremely low sulphur rates, the water may reach 100 gpm, requiring water pressure on the plant end of 1400 psig.

At the shore terminus, liquid sulphur is to flow directly into insulated tank-barges which will be towed over an inshore route 25 miles to Port Sulphur. Water from the 7⅝-in. line will be cooled from 280 deg F to atmospheric temperature and returned through a 4½-in. OD line to the mine for reheating and re-use. To prevent corrosion and scale deposition within the 7⅝-in. pipe, the water will be purified.

Under the present design, the 4½-in. return line is strapped to the outside of the 14-in. casing as is the 6⅝-in. OD pipeline. The line serves two purposes: one, it provides additional supporting surface for the pipeline in very soft clay; two, it affords a limited source of fresh water for the mine. Fresh water from the Mississippi for camp use will be carried as ballast from Port Sulphur in returning sulphur barges and then pumped to the mine.

A unique feature of the Freeport pipeline plan is the method for overcoming thermal stresses. Inner lines would normally expand about 55 ft when heated from 75 deg to the 300 deg F operating temperature. Expansion joints or loops are the usual means of providing for expansion, but in a buried line they might not be effective and their cost is considerable. The pipeline will be anchored so the 55 ft of movement does not take place. Stress imposed on the pipe walls will exceed the yield strength of ordinary steel so the inner lines will be constructed of a high tensile steel having a yield strength of 60,000 psi. Stress on the 14-in. casing will be less and Grade X-42 steel having a 42,000 psi yield strength will be used.

Before being buried the outer casing is to be placed in 10,000 psi tension by a pull on each end and the ends fixed to an anchor structure while still in tension. When the line reaches its operating temperature of 110 deg F, tensile stress is to be relieved.

The inner lines are to be heated to 225 deg F and allowed to expand their normal amount of 35 ft. While expanded, each end of the inner lines will be permanently fastened to the outer casing, which in turn is anchored to the structures. When they are placed in operation and reach a temperature of 300 deg F, thermal stress will be compressive and combined stresses will be about 60% of yield strength. If the inner lines should be cooled to atmospheric temperatures, thermal stress would be reversed to tension and combined stresses are calculated to amount to 70% of yield strength.

The anchor structures will be used only temporarily. After the soil becomes remolded to the pipeline, soil resistance is expected to be sufficient to prevent appreciable movement. No movement is anticipated on the shore end because the line for more than two miles will be buried in fine sand. At the mine end, the line will be buried in very soft clay which should yield somewhat to the pipeline stresses.

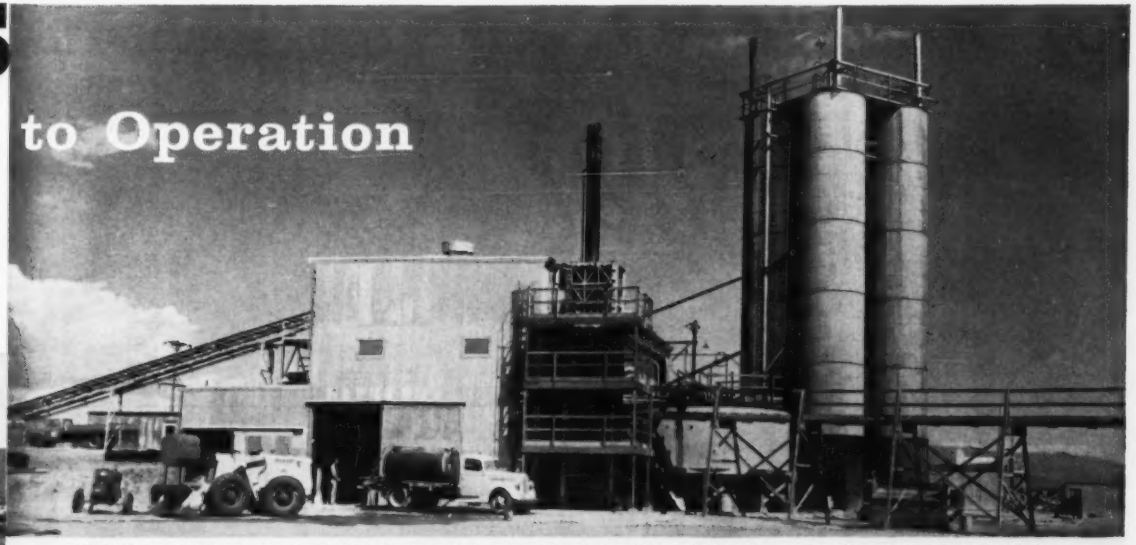
FOR YOUR FREE COPY OF E&MJ's ANNUAL INDEX 1958 MARK AND MAIL THE REPRINT CARD OPPOSITE PAGE 51.

Garfield Smelter Is Due

80 DAYS
from Excavation to Operation

Experience, planning, and cooperation make possible the record breaking construction of the new Cotter Corporation Uranium Mill.

APRIL 21—The first ground is broken on the site of the Cotter Plant near Canon City, Colorado. The fullest possible cooperation of Cotter Corporation officials greatly speeded construction.



JULY 19—Production started, but WKE engineers are still on the job to insure the most efficient operation of the plant at its designated capacity. The final tally shows the job completed ahead of schedule and below the estimated cost figure.

Send For Complete Information
Department E. J.

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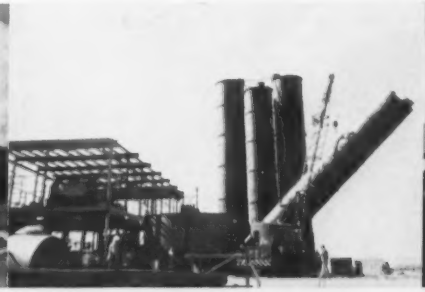
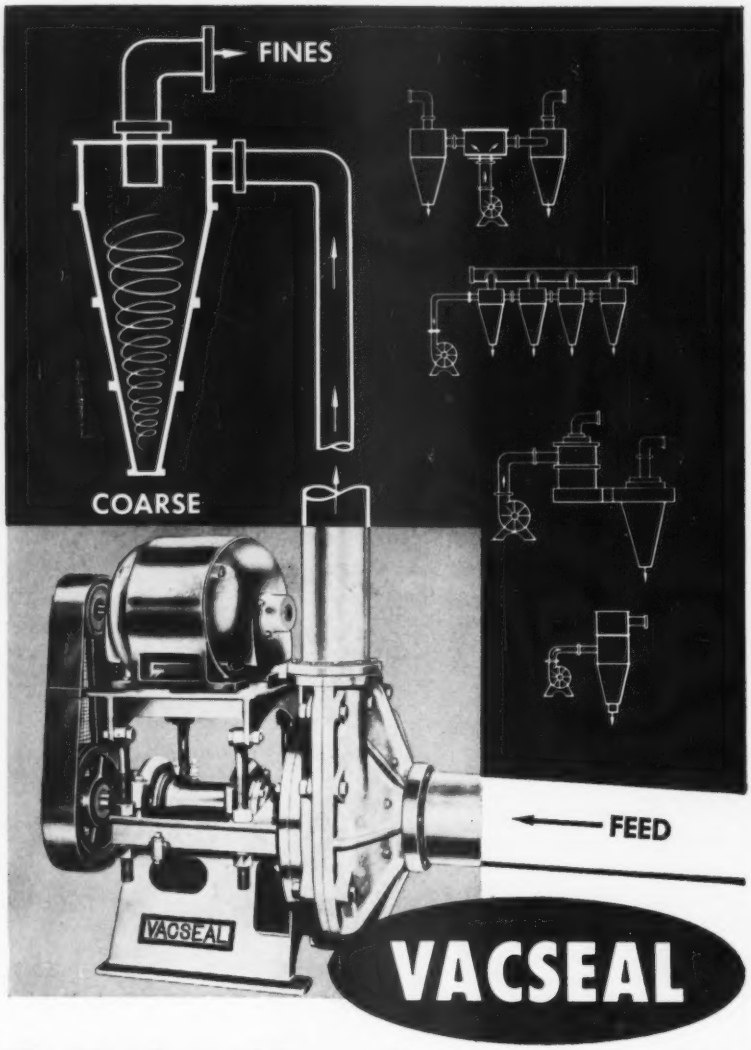
MAY 19—One of many innovations used to speed construction was this solid slab used in preference to time consuming individual footings. AEC contract committments made every minute count.

MAY 26—Building sections of the mill frame on the ground and hoisting them into place was another common sense, clock-beating technique used by WKE engineers. Techniques like this kept production up—overtime down.

JUNE 9—The fourth Pachuca leach tank is set in place just forty-nine days from the start of the job. These tanks and other large equipment units were prefabricated, simplifying erection on the job site.



JUNE 16—The nearly completed exterior of the plant shows in the background as workmen finish installing ore conveyors. With nine other Uranium Concentrators on the completed list, WKE experience was the big plus in the battle against time.



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In the rapidly developing field of cyclone separation, VACSEAL is enthusiastically accepted as the dependable, efficient liquid-solid pump. It is now being successfully used in many industries, including: coal, sand, chemical and metallurgical as the essential feed unit for the cyclone method of size classification.

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We invite correspondence and suggest you write today for literature that gives the reason why VACSEAL Pumps can meet cyclone feed requirements at low cost.

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Garfield Smelter Is Due For $10-Million Overhaul

UTAH COPPER DIVISION of Kennecott Copper Corp. will spend $10-million in renovation and modification of the Garfield, Utah smelter formerly owned by American Smelting and Refining Co.

Kennecott bought the smelter last year for some $20-million.

It handles the total output of concentrates from KCC's Arthur and Magna mills.

Kennecott's principal change will be from roasting of concentrates prior to firing in reverberatory furnaces to "green firing" of the concentrates directly to furnace.

This latter procedure is followed by KCC at other western divisions.

KCC will eliminate the 48-odd roasters, fire the concentrates by conveyor belt directly to the top of the five reverberatories at Garfield. The reverbs are presently "gun fed."

The reverberatories will be enlarged and greatly rebuilt—including installation of new high arches and use of magnesite refractories in lining.

Automatic car-dumping of concentrates also will be installed, replacing the crane used at present.

Modification of sampling will be extensive. Asarco had carried on a custom business at Garfield. Custom purchasing has ended with Kennecott control. Custom smelting also necessitated the use of roasting which lent itself to concentrates blending as well as mixture with silicious ores.

Consideration also had been given in engineering for a pipeline to haul concentrates in liquid solution from mills for filtration at the smelter. This would eliminate present railroad car haul. However, this proposal has been shelved for the time being.

The $10-million to be spent at Garfield is part of an over-all $90-million program of expansion, integration and modernization which the world's largest copper producer is undertaking.

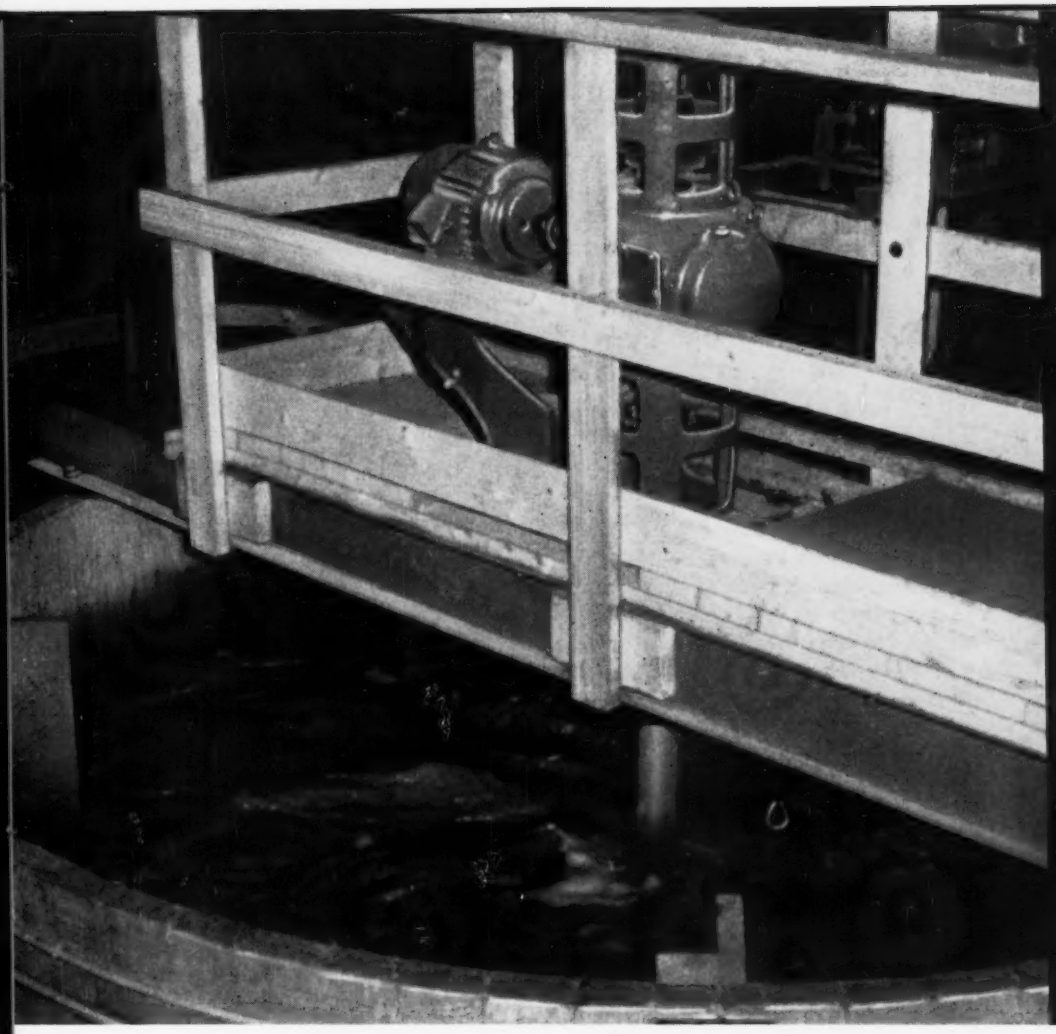
In all, the firm plans to spend $172-million dollars between 1958 and 1961, according to treasurer E. S. Hann, New York City.

Bingham's Fourth Tunnel Is Opened in Record Time

UTAH CONSTRUCTION CO. has completed the longest single-track mine tunnel in the world at the Bingham open mine of Utah Copper Division, Kennecott Copper.

UCC finished the project approximately nine months ahead of the early-1960 completion deadline.

The $11-million tunnel, to be used initially and primarily for ore haulage from the bottom of the pit of the big copper producer, is 18,000 ft long. It is called the 5,490 tunnel and will not be put to use until pit bottom (sinking) intersects its terminus. The bottom of the pit is now about 150 ft above the tunnel depth which when measured from



Fast Dispersal in 11-ft-dia., 12-ft-deep precipitation tanks is gained by using LIGHTNIN Mixers. For mixer details, request Catalog B-102.

Bicroft Uranium Mines Ltd., Bancroft, Ont.

How **uranium extraction** *gets a helping hand with mixing like this on the job*

In the precipitation tanks at this mine, fluid mixing has to walk a very narrow fence.

It must disperse alkali quickly through the ore, for uniform pH.

But it must also be gentle enough not to break down the delicate uranium oxide floc into a powder that could clog filters, cause stoppages and lower the efficiency of the entire extraction process.

The mixer you see here is one of several installed after a LIGHTNIN Mixer representative asked questions, took samples, and later returned with recommendations based on actual tests run in the laboratory. These LIGHTNIN Mixers are scale-ups of the mixers that solved the problem in the lab. They provide *precisely the balance of horsepower, speed and mixing action* to meet the critical requirements of the process.

Floc stays filterable. And pH quickly arrives at its desired uniformity.

Easy To Install

Installing these units was simple, because all LIGHTNIN Mixers are shipped fully assembled, factory-aligned, ready to install. Standard interchangeable components and easy access to all parts make maintenance easy. Aside from ordinary servicing, these mixers *have required no repairs or attention since going on the job 2½ years ago!*

Results Guaranteed

LIGHTNIN Mixers have many uses that can pay off for you. This mine also uses them to mix the magnesia slurry that controls pH when added to the precipitation tanks, and in making up barren eluate. You can also use them to blend ores in pulp form, speed chemical reactions, condition feed for flotation cells, or solve other fluid-mixing problems. Sizes range from ¼ to 500 HP, and *results are fully predictable, unconditionally guaranteed.*

There's a skilled LIGHTNIN Mixer representative not far from you. Look him up in Thomas' Register—or write directly to us.

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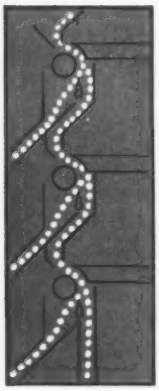
EXPERT INVESTIGATION

Stearns technicians — backed by 50 years of experience in magnetic separation research and the design and development of efficient magnetic equipment — will make a careful, scientific analysis of your sample. Procedures will include a thorough investigation of the feasibility of magnetic separation, and a comprehensive report will be submitted, recommending specific magnetic equipment for optimum results.



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For complete information, write to Stearns Magnetic Products, Dept. 800D-2.

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Bingham *(Continued)*

points on upper lip of the pit is itself 1800 feet below surface.

The tunnel is 18 ft wide and 24 ft high. It was started Oct 30, 1956, to connect pit bottom with the Copperton (ore and waste train) assembly yards at the mouth of Bingham Canyon.

This is the third haulage tunnel at Utah Copper. The first (6,040) was completed in 1945, having been started during the war. The second (5,840), less than half as long as the latest venture, was finished in 1953.

Purpose of the tunnels is to eliminate uphill haul of ore and waste around the interior of the pit, thus reducing mining costs.

Utah Construction is currently removing its trackage and facilities used in driving the bore. Kennecott eventually will install its own track as well as centralized traffic control.

The tunnel project was under direction of Paul C. Quinn, project manager for Utah Construction. Project engineer for the contractors was C. A. Mason; M. F. Findlay was tunnel superintendent.

Magcobar To Mine Alberta Bentonite

GREATER USE of extensive bentonite deposits in Alberta is in sight with construction of a manufacturing plant in central Alberta designed by Magcobar Drilling Mud Co., Calgary, to meet all bentonite requirements of the oil industry in Canada.

The Calgary-based company is a branch of Magnet Cove Barium Corp., a member of the Dresser Industries. The company has located the $400,000 plant at Rosalind, 25 miles southeast of Camrose. Deposits of bentonite are about ten miles from the plant site. The company has an estimated 3,000 to 4,000 acres under lease in the area from the Provincial government and private owners. Production was expected to start during the spring.

Fred S. Parker, Calgary, company vice-president, said that the plant will be capable of meeting the oil industry's bentonite requirements for all of Canada. These requirements were estimated at about 25,000 tons of bentonite per year. Used chiefly to control the viscosity of drilling mud, bentonite previously has been imported for the most part from the U.S.

Parker said that the firm has sufficient deposits for the foreseeable future.

Although Alberta has extensive bentonite beds, there has been only minor development. There has been limited production in the Drumheller area where operations have been in connection with coal mining.

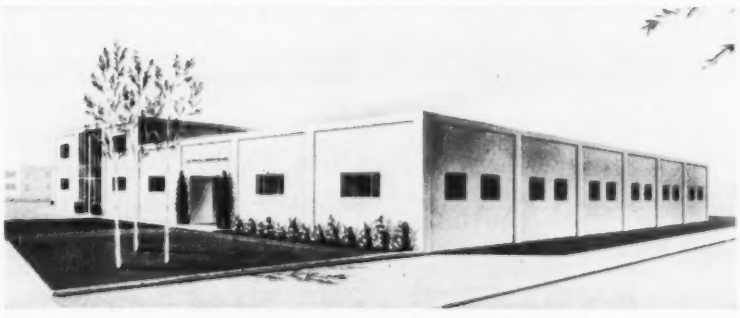
A report by members of the Research Council of Alberta states that deposits of bentonite are widespread in Alberta, being found in the Cretaceous and Tertiary strata. Thick accumulations, up to 30 ft, have been reported from the upper Cretaceous.

ACOJE MINING COMPANY CHROME OPERATIONS, ZAMBALES, PHILIPPINES

KREBS CYCLONES...3 years of increased recovery with no replacement of parts

Installed in 1955 and paid for with savings in 3 weeks by increased recovery, Krebs Cyclones at Acoje have now operated for over 3 years with no replacement of Krebs Molded Rubber Liners. Scores of other operations have also made gains by the desliming and upgrading performance of Krebs Cyclones used ahead of tables, spirals, classifiers, thickeners, sizers and screens.

Equipment Engineers' Pilot Plant in Palo Alto, California, made full scale studies of Acoje samples prior to the installation and results were confirmed in the Acoje plant. Our Palo Alto facilities are being expanded that we may continue to serve the Mineral Industry more effectively.



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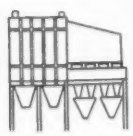

PRECIPITATOR-CYCLONE COMBINATIONS

Buell Cyclones before installation at a major plant.

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Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Magcobar *(Continued)*

Bentonite deposits in the Busby area, 40 miles north of Edmonton, warrant further exploration, states the report. In the Busby area there are known deposits of bentonite, 3 to 30 ft in thickness beneath 10 to 50 ft of overburden. In general, the yield ranges from 40 to 60 barrels per ton, though some smaller areas with yields up to 115 barrels per ton have been reported.

Argentina Invites Bids To Develop Iron Mine

INTERNATIONAL TENDERS have been invited by Gen. Armando Martigena, director of Argentina's Direccion General de Fabricaciones Militares for development of a 200,000-ton iron ore deposit in Sierra Grande, Rio Negro province.

With 70,000 tons actually proven, the government estimates the grade of ore at 55 to 60% Fe and characterized by "variable magnetism." The national agency emphasizes that the potential for a steel complex is present in the area, with a 650,000 kw power station planned at El Chocon, and expansion of the Rio Turbio coal mine to 3-million tons output per year.

Greenland's Lead-Zinc Mine Nears Exhaustion

THE exhaustion of the unique lead-zinc mine at Mestersvig, in Greenland, is expected within three years, according to Danish sources. The mine plant, which was built into the side of a cliff as protection against the intense cold, can only ship about two months per year, and must produce at capacity to show a profit.

Production from the mine in 1957 was 80,000 tons, which produced 7,300 tons of lead and 8,500 tons zinc.

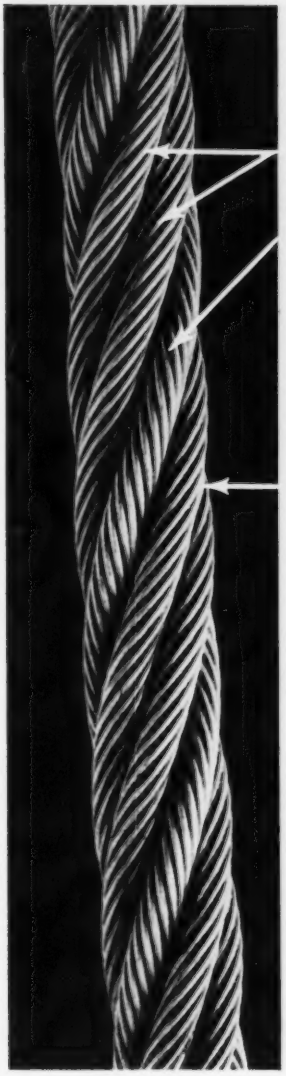
Two New Zinc Plants Are Planned for Spain

ANNUAL OUTPUT of 32,000 additional tons of electrolytic zinc is forthcoming from two new plants to be built in Spain. Sociedad Austuriana del Zinc, a new firm, which is 40% owned by Real Compania Asturiana, will build an electrolytic plant at Aviles to produce 20,000 tpy.

Minera Celdran, S.A., which has been mining and exporting zinc ores from Cartagena province, will begin production this year from a 12,000 tpy plant.

New Tanker Will Haul Molten Sulphur in Gulf

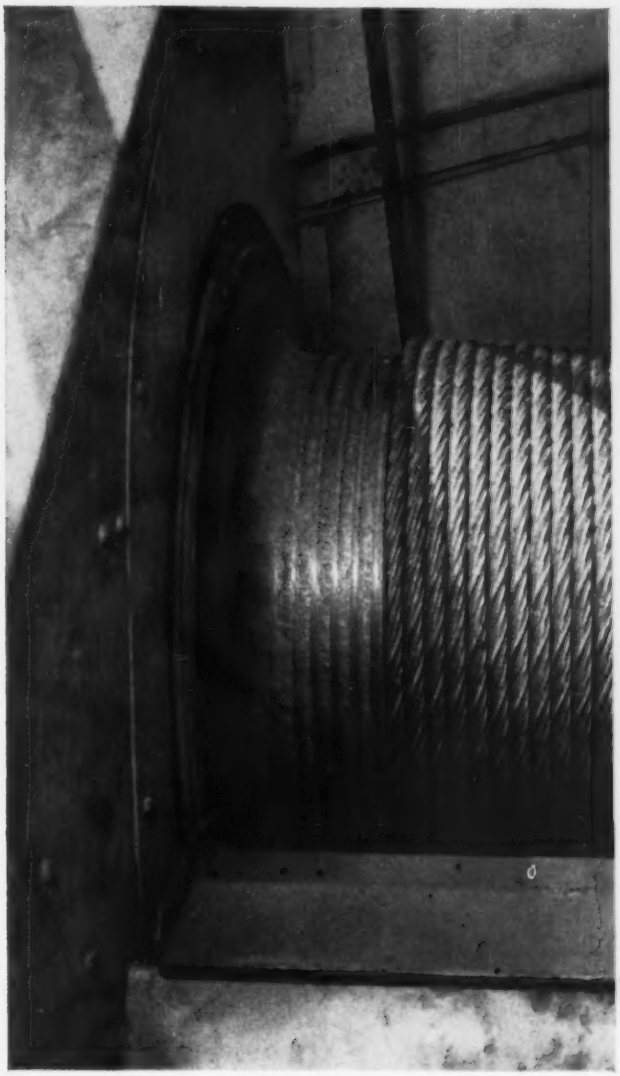
TEXAS GULF SULPHUR Co. has announced plans to establish a molten sulphur terminal at Tampa, Fla. supplied



Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristic.

Heavier outside wires in each strand have greater resistance to abrasion.



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Herringbone delivers extra flexibility, extra abrasion resistance, unusual structural stability, extra resistance to shock, easy operation over sheaves and drums and smooth spooling properties.

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The LLV's efficient dust collection keeps holes clean for faster, deeper penetration — prevents stuck steels and lost holes. Its powerful suction removes cuttings through the hollow drill steel and out the side of the chuck housing. *None* passes through the machine. Results: less maintenance and longer tool life.

What's more, dry cuttings permit continuous ore sampling — and all can be reclaimed!

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AT-908

Sulphur *(Continued)*

by the first ocean-going vessel designed for shipment of sulphur in molten form.

A converted Liberty ship, with steam-heated tanks capable of holding 7,500 tons of molten sulphur, will begin making the trip from Texas Gulf's terminal at Beaumont, Tex. to Tampa in August. At Tampa, the sulphur will be held in steam-heated tanks for distribution to railway tank cars or tank trucks and shipment to consumers. Present facilities at the Florida port will handle only solid sulphur.

Steep Rock Resumes Expansion Program

INCREASED PRODUCTION to 5.5-million tons per year of iron ore from Steep Rock Iron Mines Ltd. is due in 1959. Steep Rock's expansion program was curtailed in 1958, but the company announced resumption at its directly-operated mines at a shareholders' meeting in mid-March.

At the Caland mine, under lease to the Inland Steel Co. on a royalty basis, upper ore levels have been exposed. Caland will begin shipping in 1960, on a contractual minimum of 3-million tons per year.

IN THE U.S.

ALABAMA

The first round in a proposal by Republic Steel Co. to mine Red Mountain, near Birmingham, was defeated in early March when the city's Zoning Board unanimously refused to rezone the presently-residential area for mining.

Republic appeared with a citizens group which cited the economic benefits of opening up the iron ore deposit, and offered to donate a park to the city between the proposed mining area and other residential areas. Republic did not announce any further action to repeal the Zoning Board decision, but future moves are anticipated.

ARIZONA

A manganese mining and drilling operation employing Apache Indians at Gleason Flats near Globe, has been started by Louis Ellsworth Jr. of Globe on property leased from the Indian service.

Mid-West Resources, Inc., of Bismark, N.D. will work the property. Mid-West has moved $240,000 worth of equipment to the site from Wikieup, where it has completed a molybdenum mining contract.

In its annual report, Inspiration Consolidated Copper Co., P. D. I. Honeyman, president, notes that the company

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4. VICTAULIC FULL-FLOW FITTINGS team up with our couplings and lightweight pipe to provide a *complete VIC-EASY system*...cuts costs of installation *and* operation.

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Arizona (*Continued*)

is now moving ahead with a three-year, $15.8 million program to bring the Christmas Mine, located at Christmas, into production at a rate of about 36-million lb copper annually.

"We look for a better year in 1959," Mr. Honeyman stated, "and we now feel justified in moving ahead to complete development of the Christmas Mine: sink the main production shaft, construct the necessary plant and housing facilities and bring the new mine in production." Proven and probable ore reserves of the mine are estimated at 20-million tons averaging 1.83% copper, with good chances for developing additional tonnage of ore.

Mr. Honeyman estimates that an additional expenditure of $5.5-million will be required in the Christmas Mine, of which about $3.9-million will represent development chargeable to income and approximately $1.6-million will represent depreciable mining equipment. Surface plant facilities, housing, etc., will require additional investment of approximately $10.3-million. The property could be ready to start production within three years.

CALIFORNIA

Although mining activity in and around Kern County has come to a pretty stolid standstill, at least one operator has heartening developments to report. Nicholas Habib of the Crown Uranium Co., Taft, reports that he has found markets for sulphur he has mined from claims near Taft and Fellows. He has sold several thousand tons of the sulphur to the Brimstone Sulphur Co. of Oildale to be used as a soil conditioner in conjunction with gypsum.

In other mining activities, he is reducing low-grade uranium ore for shipment to Utah mills and is in the process of selling an unspecified amount of diatomaceous earth.

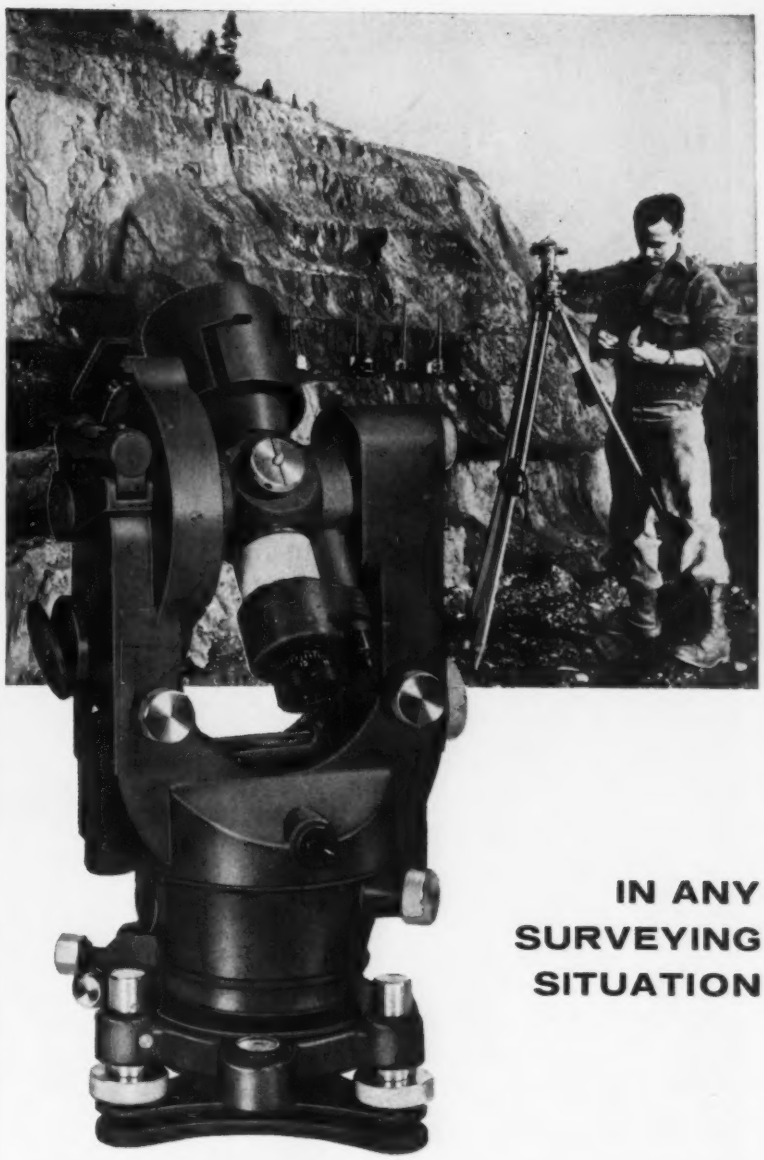
COLORADO

A major revival of hard rock mining in the Silverton district is proposed in a deal completed among United States Smelting Refining & Mining Co., Marcy-Shenandoah Corp. and Standard Uranium Corp.

Oscar A. Glaeser, vice president and general manager of western mining divisions at Salt Lake City for USSR&M, announced lease of that firm's Sunnyside mine near Silverton to Marcy-Shenandoah for a 15 year period with right of renewal for another 25 years.

At the same time, W. R. McCormick, president of Standard Uranium at Moab, Utah, announced acquisition of 50% of the assets of Marcy-Shenandoah for undisclosed considerations.

Marcy-Shenandoah was organized to consolidate various mining properties in the Silverton district, Mr. Glaeser said. The firm purchased the mine and mill



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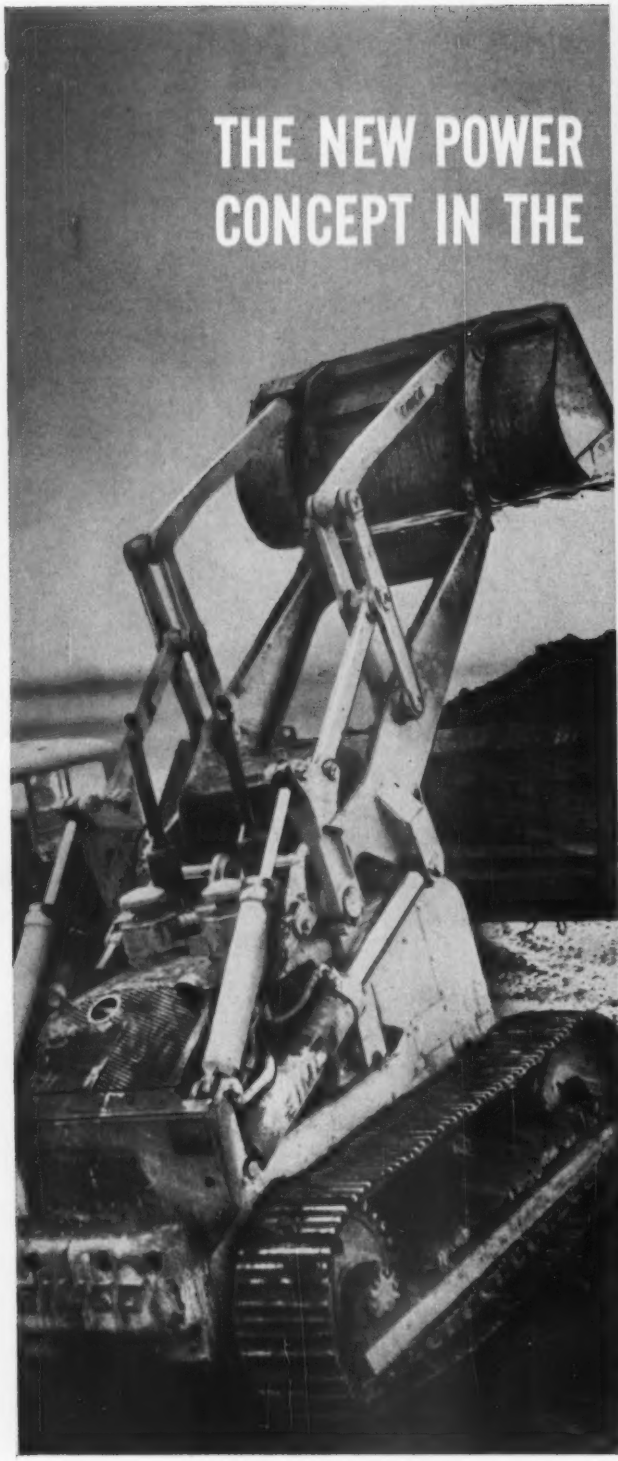

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(20 TO 1650 H.P. IN ONLY

THE GM DIESEL ALL-PURPOSE POWER LINE 20 to 1650 H.P. in only 3 cylinder sizes

NON-TURBOCHARGED RATINGS

NEW
"2-53"
20 to 47 H.P.

"2-71"
33 to 67 H.P.

NEW
"3-53"
38 to 97 H.P.

"3-71"
51 to 118 H.P.

NEW
"4-53"
51 to 130 H.P.

"4-71"
69 to 167 H.P.

NEW
"6V-53"
76 to 195 H.P.

"6-71"
112 to 252 H.P.

Now, all the benefits of engine standardization come to every mine with any type of equipment

Whatever equipment a mine needs, there's a "Jimmy" Diesel tailored to it. So now you can standardize on GM Diesel power and buy the finest equipment available.

For example, you can power a 15-kw. generator, a 265-c.f.m. compressor, a 200-350 h.p. ore truck, and even a 1,000-h.p. dragline, *all* with "Jimmy" Diesels. And it's *all* top-quality equipment because it *is* powered by GM Diesels.

And there's good reason for standardizing on "Jimmy" Diesel power—new compactness, light weight, high efficiency, durability, inexpensive maintenance and lowest parts cost, plus one more reason—most important of all—the *unmatched parts interchangeability of "Jimmy" Diesels.*

GM Diesel covers the whole power spectrum with *only 3 cylinder sizes*—many parts that fit a 33-h.p. "Jimmy" also fit a 1650-h.p. GM Diesel. Thus, mining firms can keep a minimum stock of engine parts—far fewer than if they used a number of different Diesels or even standardized on any other make Diesel.

Want to know more? See your nearest GM Diesel distributor or write GM Diesel, Dept. M-4, Detroit 28, Michigan. Call or write today—there's money in it.

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GENERAL MOTORS, DETROIT 28, MICH.

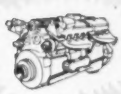
In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

NEW
"6V-71"
112 to 252 H.P.

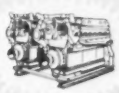
NEW
"8V-71"
150 to 334 H.P.

"6-110"
160 to 335 H.P.

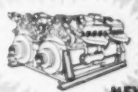
NEW
"12V-71"
224 to 504 H.P.



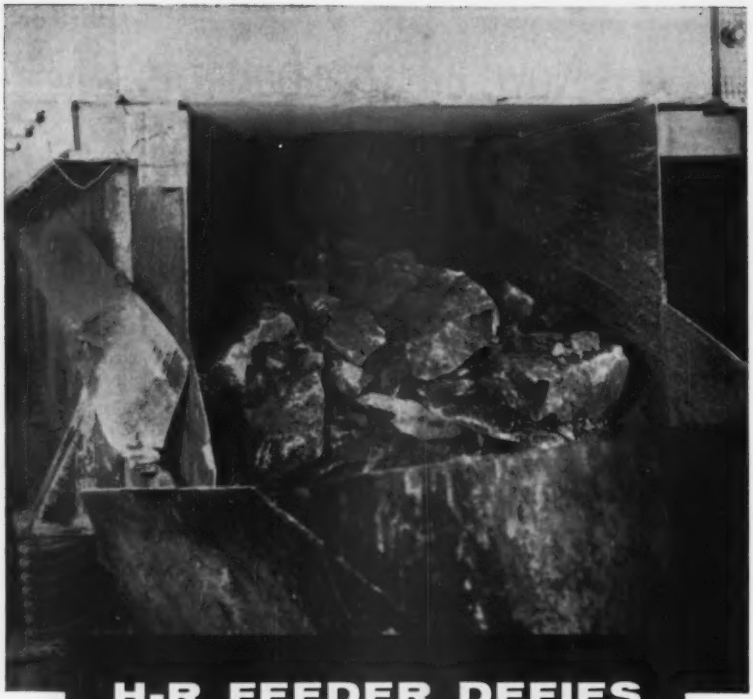
NEW
"16V-71"
300 to 675 H.P.



NEW
"24V-71" (Twin 12)
448 to 1008 H.P.



NEW
"32V-71" (Twin 16)
600 to 1350 H.P.
(Turbocharged—1650 H.P.)



H-R FEEDER DEFIES 4 MILLION TON 3 YEAR BATTERING

This Hewitt-Robins extra heavy duty vibrating feeder has handled, at 500-550 TPH, 4 million tons of minus 24 in. crushed rock—rock which has fallen 9 ft. from a primary crusher to the 2 in. thick feeder deck which, after more than three full seasons, shows absolutely no sag and less than ¼ in. of wear. Maintenance costs? Only routine lubrication and one change of V-belts. What's more, this H-R feeder has paid for itself in conveyor belt savings in three years.

This rugged performer is available with long-wearing, special non-plugging grizzly decks to handle the most slivery material; stainless or alloy steel pans for extremely sticky materials; heavy, abrasion-resistant steel liners; and special extremely heavy pan construction for heaviest impact. This means added performance and economy to your operation, whether you handle material in lumps up to 3 or 4 ft. cubed, sticky material, such as wet iron ore, or exceptionally abrasive materials, as coke and sinter. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 4-16.

HR HEWITT-ROBINS

VIBRATING CONVEYORS, SCREENS & SHAKEOUTS . . . CONVEYOR BELTING AND IDLERS . . . POWER TRANSMISSION DRIVES . . . INDUSTRIAL HOSE

Colorado *(Continued)*

of the old Shenandoah-Dives Mining Co. and leased certain other properties of the American Smelting & Refining Co.

Standard itself has acquired properties in the area.

Under the USSR&M-Marcy arrangement, the American tunnel will be extended to the leased premises and connections will then be made to this tunnel and certain existing mine workings, Glaeser said.

This work will provide access at lower elevations to anticipated ore horizons, he said.

McCormick said that the 6800-ft American tunnel would be renovated and extended an additional 4800 feet. A 480-foot raise will be effected at tunnel's end. A 4,000 foot drift will then be driven from the raise to a known ore area in existing workings.

He said that assays in hand indicated potential 480,000 tons of $37 rock containing values of lead, zinc, silver, gold and copper.

Ore will be milled in the old Marcy-Dives concentrator which has capacity of 650-660 tpd. Smelter arrangements are pending.

Mr. Glaeser said that the Sunnyside mine had produced substantial quantities of lead and zinc prior to 1939 and that the Marcy-Shenandoah lease constitutes a step toward a "rejuvenation" of the mining camp.

Standard will be operator on the Marcy-Shenandoah properties and Sunnyside lease.

Gold receipts at the Denver Mint declined to 69,214 oz worth $2,422,510 in January from 76,972 oz valued at $2,694,053 in January 1958, mint officials report.

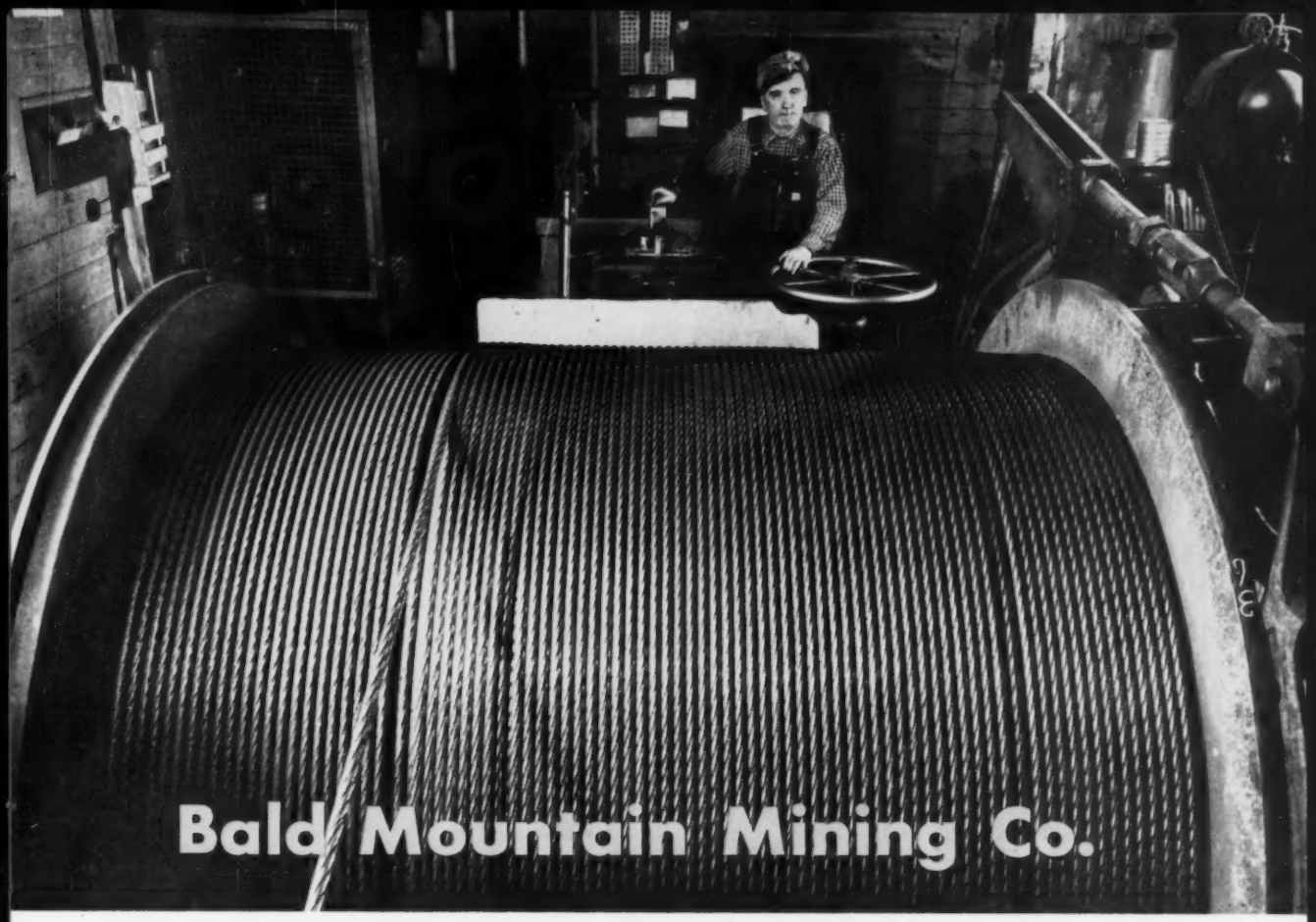
Receipts of silver were down to 17,613 oz worth $15,901 from 545,191 oz worth $493,307. Silver receipts have been down since late 1958 as a result of a rising world price for the metal. The U.S. government fixed price for silver is 90½¢ per oz.

The outlook for Climax Molybdenum Co. in 1959 shows greater promise now than at any time during recent months. This note of optimism was expressed by resident manager Robert Henderson as he commented on company operations during 1958 and the future prospects for Climax.

Coupling this encouraging view of the future with a review of 1958 activities at the Climax mine, Henderson said the impact of the national recession created a number of problems which his company and its employees had to face during the year.

'However," he added, "with the improvement in economic conditions in the fall of 1958, many of these problems were resolved and we are progressing favorably in the direction of our recovery goals."

Golden Cycle Corp. has issued a preliminary report covering information made available at the annual meeting covering highlights of operations in 1958.



gets 21% longer rope life with Yellow Strand Flattened Strand

A service life increase of 42% over the 40-year average, and 21% over the best competitive ropes! That's the amazing record for Yellow Strand Flattened Strand told by Bald Mountain Mining Company at their mine near Trojan, South Dakota.

Using 4500′ of ¾″ 6x8 Yellow Strand Flattened Strand, ore cars are hauled up from the mine on one side of Bald Mountain . . . then lowered down the other side to the loading chute.

At rope speeds of 700-800 fpm, one string of Yellow Strand Flattened Strand helped move 97,000 tons of ore during its record 1⅔ years of service.

Exceptional service life like this can be yours, too. Check with your Yellow Strand Distributor—today!

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- No obstructions, pockets or internal parts
- Tight on grits to 1/8"
- Maintenance free

More than six years of service carrying abrasive materials that had ruined iron gate valves in four weeks — and still no signs of wear! That's the kind of record FLEX VALVE has chalked up in mining operations. FLEX VALVE's tough valve body materials have resisted the onslaught of steel shot, stone, coal ore, mine tailings, cement, other valve-destroying matter for thousands of hours of trouble-free service. Here is the simplest valve made . . . An integral part of your piping with no internal parts to stick or wear, no diaphragms or packing to leak. The original pinch-type valve — built by Farris for the mining industry's toughest service. In manual or motor-operated types.

FREE TWO VALUABLE BOOKS ON FLEX VALVES

Detailed engineering data, plus special sizing charts are in FL-1116R Flex Valve catalog; Bulletin FL-935 lists several hundred typical uses. Both books yours for the asking.

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Representatives in All Principal Cities

Colorado *(Continued)*

From the preliminary report issued on Jan. 29 the following progress is reported.

As in 1957, decreased tonnage treated in the Golden Cycle Carlton Mill at Cripple Creek was due to decreased production from the Cresson mine and shipments from dumps. This increase in the ratio of mined to dump ore caused a corresponding increase in the average ore grade treated.

An application to construct at the Carlton Mill a 200-tpd uranium extraction plant to treat Colorado Front Range uranium ores was filed by United Western Minerals Co. and Golden Cycle with the Atomic Energy Commission July 3, 1958. At a conference Jan. 12, 1959, Commission officials said they were awaiting completion of metallurgical tests by the Bureau of Mines testing laboratory at Salt Lake City before making a final decision as to granting the mill contract for the Colorado Front Range area.

A wealth of mineral resources, as great or greater than any Colorado has known in the past, still lies tucked away deep in the hills. Hugh McKinstry, professor of geology at Harvard University, made this observation in a new study, "The Future of Mining In Colorado," prepared for the Colorado State Chamber of Commerce.

In the 28 page booklet McKinstry notes a decline in mining activity in Colorado. Yet, he says, by all geological indications, the state has huge undiscovered reserves of mineral wealth.

However, he points out that to bring the new mineral wealth into profitable production will require more expensive mining techniques than those employed in Colorado's mining heyday.

Ouray County has several small mining operations going at the present time in addition to Idarado Mining Co., the major concern in the San Juan triangle.

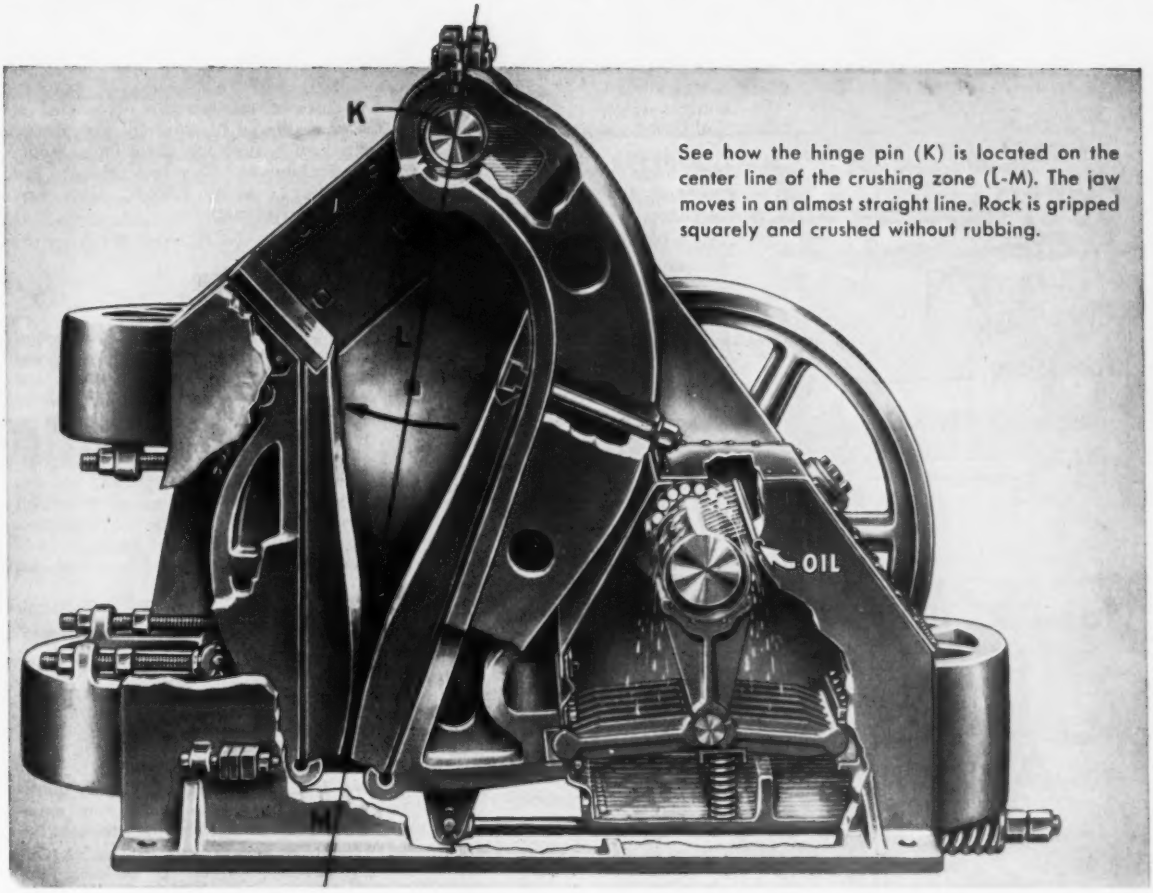
Until a short time ago, local operators or lessees were seriously handicapped by lack of a custom mill. During the past year, Bay City Mining & Milling Co. constructed a mill 3½ miles north of Ouray. After completing the plant, they accepted small lots from various groups for test runs. Since early fall, Bay City has been milling dump rock from the old Revenue mine located at Sneffles, and has made approximately 75 tons of concentrate a month, according to Roland Johnke, general manager.

IDAHO

Bunker Hill Co. of Kellogg reported it has begun the manufacture of zinc anodes at its electrolytic zinc plant.

L. J. Randall, president of Lucky Friday Silver-Lead Mines Co. at Mullan, announced plans for construction of a 400-ton mill at the company property. Randall also said a number of surface and underground improvements are planned at the company during the year.

Increase your crushing profits . . . Kue-Ken® "crushing without rubbing" lengthens jaw plate life at least 5 times



See how the hinge pin (K) is located on the center line of the crushing zone (L-M). The jaw moves in an almost straight line. Rock is gripped squarely and crushed without rubbing.

Rubbing skyrockets crusher costs . . . jaw plates wear out prematurely and power is wasted. Kue-Ken, the only crusher that crushes without rubbing, eliminates these unnecessary expenses. Kue-Ken mechanism operates in a sealed, dust-tight crankcase lubricated by filtered oil. This permits higher speeds for greater capacity allowing for a smaller, lower cost crusher. Wear is negligible and shutdowns are practically eliminated. Automatic flywheel release prevents breakage from tramp iron. Kue-Ken crushes at the lowest cost per ton. There is a size to meet every need.

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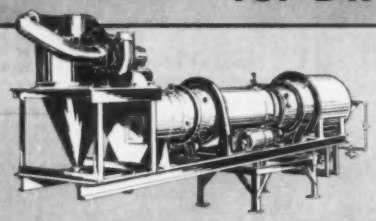
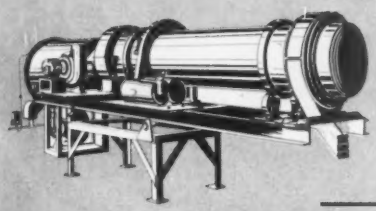
Pilot Plant or Laboratory Equipment . . .

for DRYING



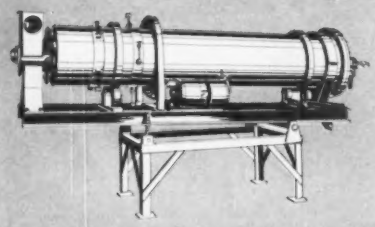
SINGLE-SHELL DRYER

Single-shell, direct gas fired rotary dryer. Arranged for either parallel or counter-flow operation. Mounted on structural steel base. Has removable "knockers." Bulletin AH-471.



DOUBLE-SHELL DRYER

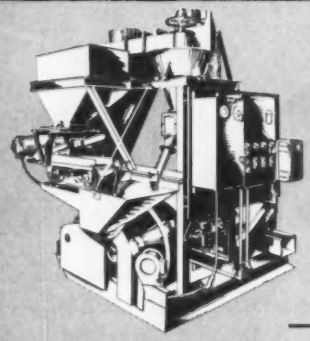
Double-shell, indirect-heat, gas-fired dryer for drying without contamination. Volatiles removed with only limited dilution. Shell rotation speed and shell slope easily changed. Bulletin AH-472.



STEAM TUBE DRYER

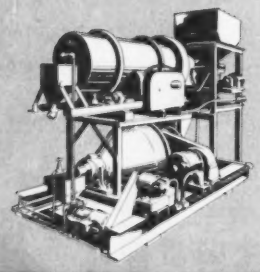
Steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Available in stainless steel or other corrosion-resistant materials. Easily moved from place to place. Bulletin AH-473.

for GRINDING AND CLASSIFYING



DRY GRINDING UNIT

Make power connections only and the Hardinge Dry Grinding Unit is ready to perform. Self-contained and portable, 7′ 8″ high. Complete with Constant-Weight Feeder, Conical Mill, "Gyrotor" Classifier, dust collector, product collector and "Electric Ear" grinding control. Bulletin AH-448.



WET GRINDING UNIT

Power and water connections only are needed to put the Hardinge wet grinding unit into operation. Self-contained and portable, 6½′ high. Includes Conical Mill, Counter-Current Classifier, launders, feeder, pump and "Electric Ear" grinding control. Bulletin AH-448-1.

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Idaho *(Continued)*

Control of Lucky Friday recently passed into the hands of Hecla Mining Co., of which Randall is also president.

Golconda Lead Mine's stockholders were advised by directors the company has no plans for resuming work at its mine near Wallace under existing metal prices. The directors reported the company's net income in 1958 at $106,685, before deductions, all from custom milling at its plant east of Wallace.

Articles of incorporation were filed at Grangeville by Idamont Oil and Mining Co. Earl E. Botsford, Great Falls, Mont.; Earl Johnson, Sheridan, Mont., and Charles L. Buck, Billings, Mont., are listed as incorporators.

MINNESOTA

The American Iron Ore Association, representing mining companies throughout the United States and Canada, has moved to new quarters in 600 Bulkley Building, 1501 Euclid Avenue, Cleveland, Ohio.

The change in address and accompanying change in telephone facilities give the national organization office and service space to continue the expansion of its statistical and educational functions, Hugo E. Johnson, president, reported.

The American Iron Ore Association was formed two years ago from the former Lake Superior Iron Ore Association, and now encompasses member companies having iron ore mining operations in almost every state and province of the U.S. and Canada.

Subhas Datta, Calcutta, and Margasahyam Iyer, from Bangalore City in southern India, young engineers who came to the Oliver Iron Mining Division at Virginia in October for training in mining methods, returned to India in February to report on what they had learned. They were surprised at the extent to which machines have replaced manual labor, and that "everyone seems to talk freely with others, regardless of position." They will return to the range in the spring for further training and are scheduled to be made supervisors. They say that lack of trained personnel is a serious problem in India.

Oliver Iron Mining Division's Pilotac plant at Mt. Iron, designed to produce 500,000 tons of taconite nodules per year, shipped 664,243 tons in 1957 and nearly .75-million tons in 1958. Since its first shipment of 104,464 tons in 1953, the plant has shipped a total of about 3.4-million tons. The gain in estimated production has been due to improved methods rather than to plant additions. Oliver's taconite pit and plants, employing about 500 men, were their only operating department to work full time through 1958.

Reserve Mining Co., with its Peter Mitchell mine at Babbitt and plant at

As shale is dumped on the grade, the 4-in-1 instantly changes from big-capacity loader to material-moving bulldozer. The operator simply lifts the clam lip, hydraulically, to switch machine actions. He regulates dozing depth with positive accuracy, using "radius control" of blade. It takes a bonafide, full-size standard dozer to match this capacity!

"Back-Dragging" with exclusive clamshell action, the 4-in-1 reduces time and cost of "dressing" a bank and pulling down "slide" rock. TD-20 shuttle-bar control speeds up back-and-forth cycles on jobs like this. Using clamshell in this position also permits speedy pick-up of stumps or loose materials that give straight buckets trouble.

"Our TD-20 Four-in-One does jobs impossible for regular dozer or loader"

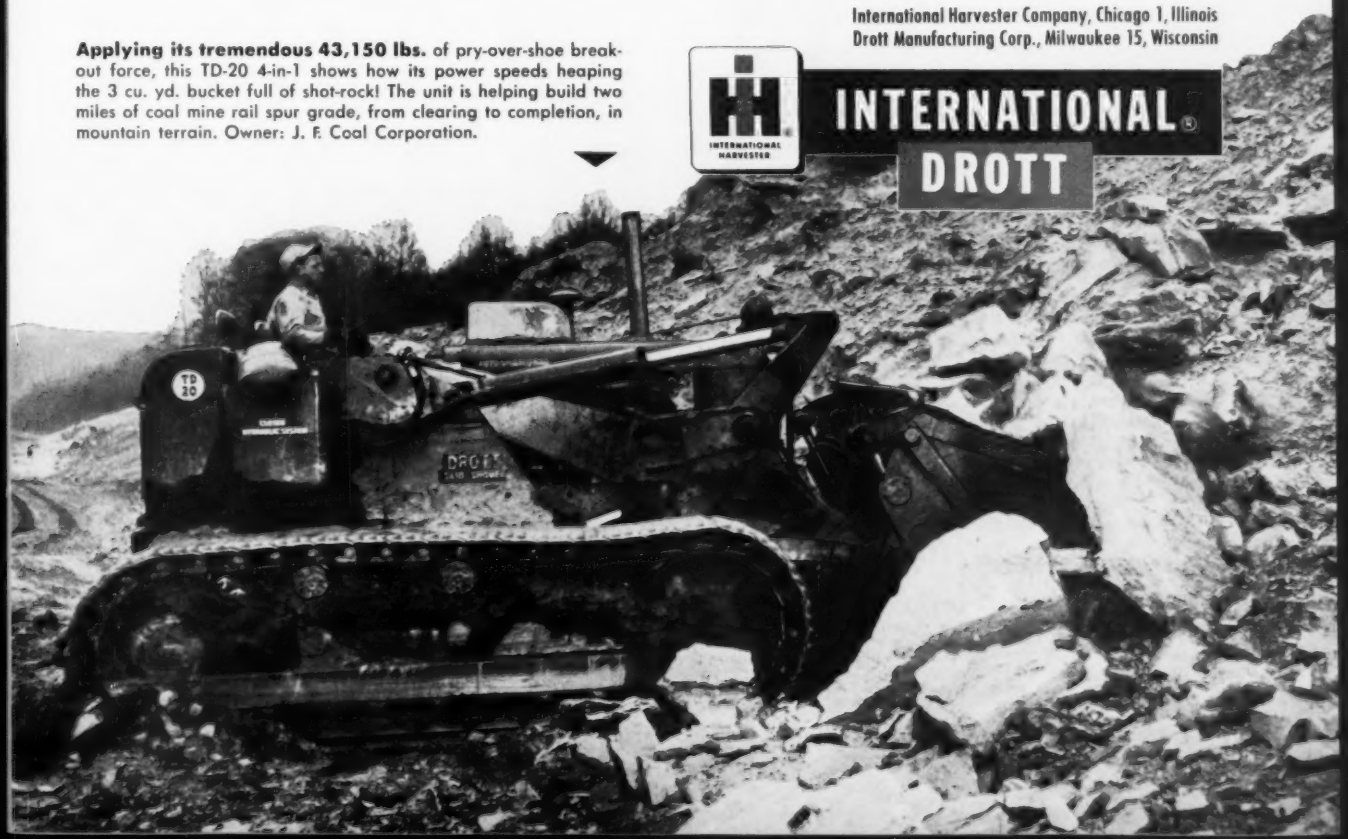
—J. F. Coal Corporation, Summersville, W. Va.

"We have used the 4-in-1 for practically all phases of this work, often doing jobs impossible with regular dozer or loader," reports Russell Patrick, Manager, J. F. Coal Corporation, Summerville, W. Va. Prove to yourself what it means to get four-machine utility—bulldozer, excavator-loader, clamshell, "carry-type scraper"—for one moderate investment. See how this "one-man equipment fleet" cuts operating cost and machinery investment—increases profit. Measure the performance-protection plus value of exclusive, shock-swallowing Hydro-Spring. See your International Drott Distributor for a 4-in-1 demonstration!

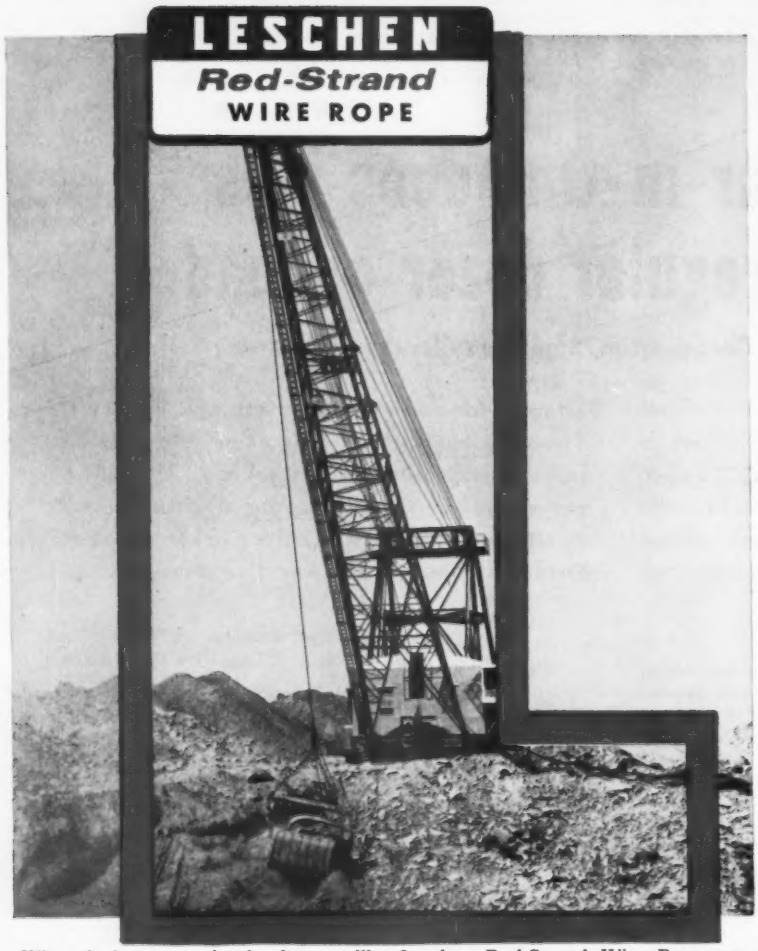
International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

Applying its tremendous 43,150 lbs. of pry-over-shoe breakout force, this TD-20 4-in-1 shows how its power speeds heaping the 3 cu. yd. bucket full of shot-rock! The unit is helping build two miles of coal mine rail spur grade, from clearing to completion, in mountain terrain. Owner: J. F. Coal Corporation.

INTERNATIONAL®
DROTT



when the going gets rough-
give 'em "L"



When the bite is on the dragline, you'll be glad you rigged with *Leschen*—the wire rope that's the same top quality in every foot of every reel. The new Leschen wire mill is designed to deliver exactly that. New machines . . . new processes . . . exclusive new continuous-flow technique—all as modern as tomorrow. Try Leschen Red-Strand Wire Rope now and see how its uniform quality makes your operation safer, your replacement time farther in the future. Make your next order Leschen! *Leschen Wire Rope Division, H. K. Porter Company, Inc., St. Louis 12, Mo.*

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Minnesota (*Continued*)

Silver Bay on Lake Superior, produced 5,421,205 tons in 1957. In 1958, though cut back 20% from March to August, it shipped 4,675,000 tons from a plant designed to produce 3.75-million tons per year. In October 1958 the plant produced a record 462,122 tons. Reserve has added 1-million tons to its stockpile capacity which now can hold 2.75-million tons of pellets. Barring strikes or other slow downs, new records are anticipated for 1959.

Erie Mining Co. shipped 2,652,000 tons of pellets in 1958. The plant is not yet in full production, but may ship about 6-million tons in 1959. At full capacity it will produce 7.5-million tons per year. Present employment numbers 2,300 which will increase to 3,000 when capacity operation is reached.

Schroeder Mining Co., operating in Fillmore county, shipped 65,115 tons in 1958 from small pits about six miles west of Chatfield. A Remer jig was used for processing the fine ores.

Oglebay Norton Co., from the St. James mine at Aurora, shipped 177,509 tons in 1958 as compared to 433,318 tons in 1957. The mine was opened by the Corrigan, McKinney Steel Co. in 1916 and operated by them until 1924. It was reopened by the St. James Mining Co.—which owns the fee—in 1952, Oglebay Norton & Co. manager.

Rhude & Fryberger, from three mines on the Mesabi range and one on the Cuyuna range, shipped a total of 357,494 tons in 1958. This production, compared to 520,265 tons in 1957, is a larger proportion than many companies shipped. Highest tonnage came from the Boeing mine at Hibbing, 165,812 tons, formerly operated by Cleveland Cliffs Iron Co. as an underground mine. The Cuyuna range mine was the Brown, a new operation, which shipped 16,386 tons from underground.

Pacific Isle Mining Co., from the mines under its operation: 16 on the Mesabi range; one, the South Chandler, on the Vermilion range; 5 on the Cuyuna and one—the Wakefield—on the Gogebic range of Michigan, shipped a total of 1,000,264 tons in 1958. Its shipments are well in advance of the group of "independent" producers of which it is the youngest member. Two of the properties shipped over 100,000 tons: the Commodore at Virginia, 127,219 tons, and the Iroquois at Mt. Iron, 266,960 tons.

In the 1958 season the Oliver Iron Mining Division maintained its usual position as the number one producer of iron ore in the Great Lakes area. Its total shipment of 18,376,941 tons was 54.9% of the 1957 tonnage and about 34.8% of the season's total shipments from the area. Oliver's shipments came from the Vermilion range, where two underground mines—the Pioneer, 747,997 tons (766,077 tons in 1957) and the Soudan—were operated through the

Michigan (*Continued*)

year, and the Mesabi range. The Mesabi shipments were from 15 properties led by the Rouchleau group in the Virginia district with over 5-million tons. In second place was the Sherman group, of the Hibbing-Chisholm district, 3,281,798 tons, and third came the Monroe group, same district, 2,386,602 tons. Five properties exceeded 1-million tons each. The Hull-Rust group was in sixth place with 896,912 tons.

M. A. Hanna Co. in 1958, as it has been each year since 1952, was in second place among the Lake Superior area operators. The difference between Hanna and Pickands, Mather & Co. has ranged from 1,119,909 tons in 1955 to 1,813,797 tons in 1957. M. A. Hanna's production in 1958 came from four mines in Michigan, all on the Menominee range, 32 on the Mesabi range of Minnesota, eight on the Cuyuna range and one in Fillmore County, southern Minnesota: a total of 45 properties. Total shipments were 8,888,951 tons of which nearly 6-million tons were from the Mesabi. No single mine shipped as much as 1-million tons though the Hunner at Coleraine, largest shipper, was close with 962,977 tons. The Hunner mine made its first shipment in 1956. The Patrick-Ann at Cooley — opened in 1917 by Butler Brothers and operated by them until 1948—was in second place with 622,066 tons. The Spring Valley, in Fillmore County and never a large producer, shipped 175,944 tons.

At Hibbing, the M. A. Hanna Co.'s Morton mine skipway has been lowered during the winter to 833 ft. The old skipway's 25 deg angle of slope has been increased to 36 deg, making a slope addition in length of 76½ ft and a vertical depth increase of 45 ft. The gear ratio on the hoist has been changed to maintain the full production capacity with the greater depth.

Cleveland Cliffs Iron Co.'s 1958 shipments amounted to 4,932,053 tons against 8,100,485 tons in 1957. Shipments from its Michigan mines were again higher than those from Minnesota, ahead by 722,937 tons. No. 1 producer was the Mather underground mine on the Marquette range, 1,231,170 tons. The Holman-Cliffs on the Mesabi range was in second place with 809,645 tons. Eight Marquette Range and six Mesabi Range properties produced the 1958 tonnage. The Republic jasper pit near Marquette, Mich. shipped 518,361 tons of pellets. Plant capacity is 600,000 tons. Operated by Cleveland Cliffs Iron Co. under the name Marquette Mining Co., the property is owned by Cleveland Cliffs, Inland Steel Co., Jones & Laughlin Steel Corp., International Harvester Co. and Wheeling Steel Corp.

MICHIGAN

Oglebay Norton Co.'s Montreal mine at Montreal, Wis., on the Gogebic range, shipped 450,282 tons in 1958. The mine's first shipment was in 1886, and its total

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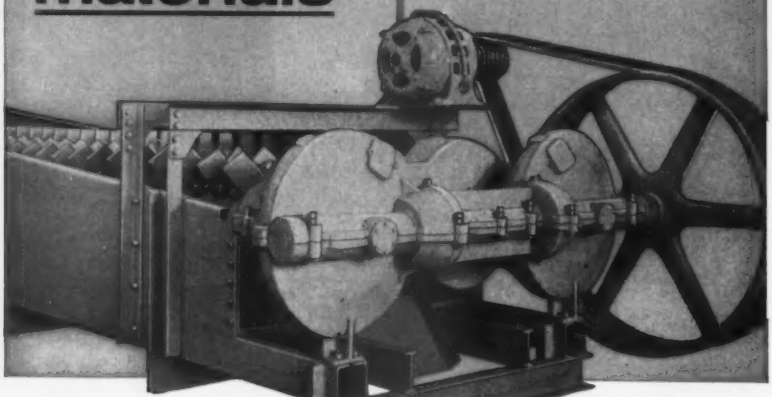

McLANAHAN SINCE 1835

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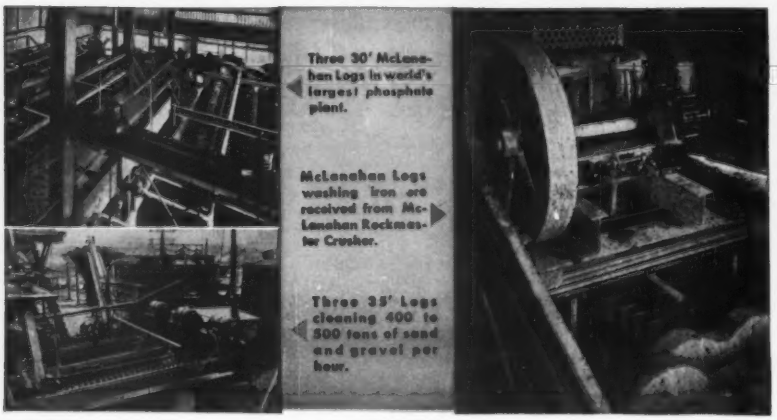

Three 30' McLanahan Logs in world's largest phosphate plant.
McLanahan Logs washing iron ore received from McLanahan Rockmaster Crusher.
Three 35' Logs cleaning 400 to 500 tons of sand and gravel per hour.

Michigan *(Continued)*

production, through 1958, is about 42½-million tons. The figure exceeds that of the Newport at Ironwood, also opened in 1886, by over 6-million tons. The Montreal has been a steady and large producer of high grade iron ore for many years.

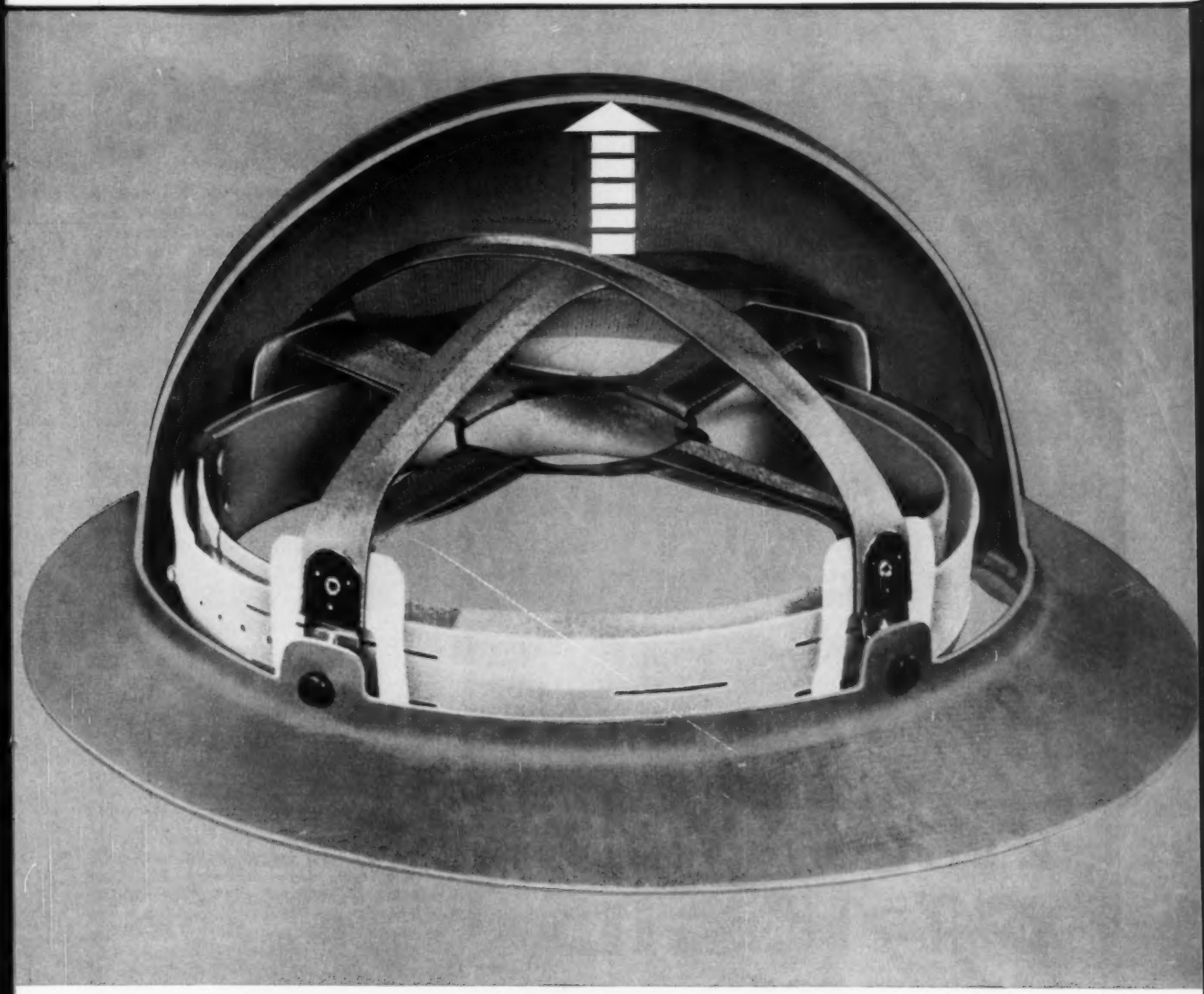
Inland Steel Co. shipped from four Michigan mines in 1958: two on the Marquette Range, the Morris with 335,-197 tons and the Greenwood, 85,188 tons; and two on the Menominee Range, the Sherwood, 471,358 tons and the Bristol, 339,941 tons. Total Michigan shipments were 1,231,684 tons. Inland's Minnesota production came from the Armour No. 1 and No. 2 mines on the Cuyuna range: total 316,404 tons.

Pacific Isle Mining Co., though most of its shipments are confined to Minnesota's Mesabi and Cuyuna ranges, has operated the Wakefield mine at Wakefield, on the Gogebic Range, for the last three seasons. In 1958 it shipped 15,822 tons from the property.

The Bradley open pit mine at Iron Mountain, Menominee Range, of the Jackson Iron & Steel Co., shipped 15,800 tons of its silecious ore in 1958. Never a large producer, the Bradley's 1958 shipment was the smallest since 1949 when it was 14,101 tons. Largest production for the last 11 years was in 1951: 41,908 tons.

A mine safety conference for mine workers in Michigan's Upper Peninsula was held at Negaunee Jan. 31. It was the first of its kind in the Upper Peninsula and was sponsored by the Institute of Labor and Industrial Relations of Wayne State University, the University of Michigan and Northern Michigan College in cooperation with the United Steelworkers of America, AFL-CIO. Speakers were: Earl T. Beeter, Duluth, conference chairman and director of district 33, United Steelworkers, on "Variations in Safety Laws of Michigan, Minnesota and Wisconsin"; John A. Johnson, Washington, D.C. chief, division of safety, Bureau of Mines, on "Health & Safety Activities of the Bureau of Mines"; A. D. Look, Duluth, of the Bureau of Mines, on "Services of the Bureau of Mines Available for Safety in Mines"; Nordy Hoffman, Washington, D.C., national legislative representative of the Steelworkers union, on "Political Measures Necessary to Enact National Safety Legislation"; Alex Christie, Washington, D.C., also a national representative of the union, on "Federal Subcommittee Report on National Mine Safety" and Michigan state representative, Dominic Jacobetti, Negaunee, on "Safety Codes Proposed by the Michigan Legislature."

M. A. Hanna Co.'s four underground mines on the Menominee Range shipped a total of 1,982,465 tons in 1958. The Cannon mine, from which the first ore from its new shaft was hoisted in March 1955, shipped 610,358 tons, making it the largest shipper from the Menominee



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There's a tamper-proof margin of safety in the new M-S-A® Fixed-Crown Suspension

Wearers of M-S-A Skullgard Hats and Caps can now be more comfortable and at the same time enjoy a margin of head safety never before assured. With the new M-S-A "Fixed-Crown" Suspension, a double cradle provides a permanent adjustment of at least a 1¼-inch crown clearance between the wearer's head and the inside top of the shell.

This clearance—so important when a heavy object falls on the hat—is made tamper-proof by a fixed upper cradle. Nothing the worker does can change the safety position of this cradle. The lower cradle is adjustable to the individual's actual head size.

Greater worker comfort is another feature of this new product. The metal suspension support is recessed into the polyethylene sweatband support in such a way as to eliminate all uncomfortable pressure points. Sweatbands are available in genuine leather or leatherette, and are so designed that they provide an air cushion for greater comfort.

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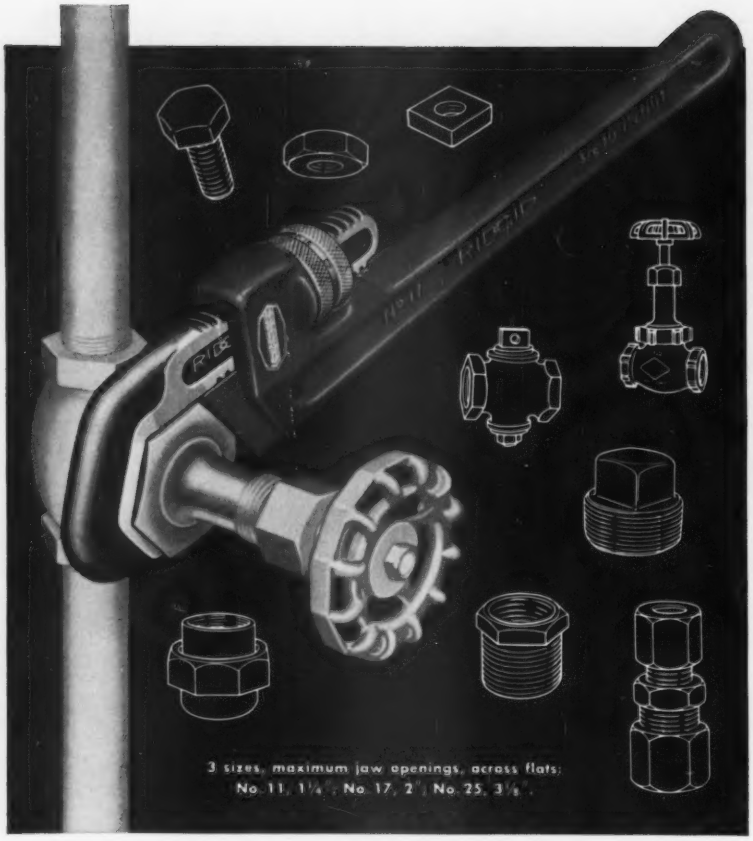

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Michigan *(Continued)*

Range for the season. The Wauseca, also an M. A. Hanna Co. property, was in second place, 570,106 tons.

North Range Mining Co. has filed its last royalty payment for the Warner mine with the Michigan state conservation department. The mine was closed permanently in September 1958. First ore was produced in 1915. The mine was closed down in 1934 and leased by North Range in 1948. Production was resumed in 1951 at 38,632 tons. The Warner has produced a total of 3,381,750 tons, 1,038-136 of which was by North Range Mining Co.

MONTANA

Hera Exploration Co. of Renton, Wash., has initiated work on 2600 ft of tunnel in the old Wallace Mining District near Clinton, 20 miles east of Missoula. The purpose of the tunnel is to explore a continuation of the copper vein in the Hidden Treasure mine and open the old Cape Nome Mine.

The company has been active in the Wallace District since the summer of 1956 when workings in the Hidden Treasure mine were renovated and modern mining machinery installed. Ore mined from development operation was processed in the custom mill operated by Clinton Mining and Milling Co. and yielded two carloads of high grade copper concentrates.

Operations at the Alice Pit in North Walkerville were suspended Feb. 28, officials of the Anaconda Co. announced. The shutdown is necessary because the company has been prevented from obtaining land needed to continue the project in safety.

The City of Walkerville has refused to vacate portions of certain streets and alleys, which were dedicated to public use and located on property now owned by Anaconda.

The company said in October 1958 that the Alice Pit, located between North Walkerville and Walkerville, could add to the zinc output of Butte and provide employment for men at the pit and in Anaconda at the smelter.

NEVADA

Round Mountain Gold Dredging Corp. halted operations at Round Mountain in Nye County during February, but plans call for full resumption of work early in April. Cold weather was blamed for the shut-down by J. E. Ashley, general-manager. Cold, ice and snow slowed work during early February and greatly decreased production of gold. Particular difficulty was experienced with the long conveyor transportation system which became clogged with ice every night. A stand-by maintenance crew has been maintained, and efforts are being made to keep the full work crew together

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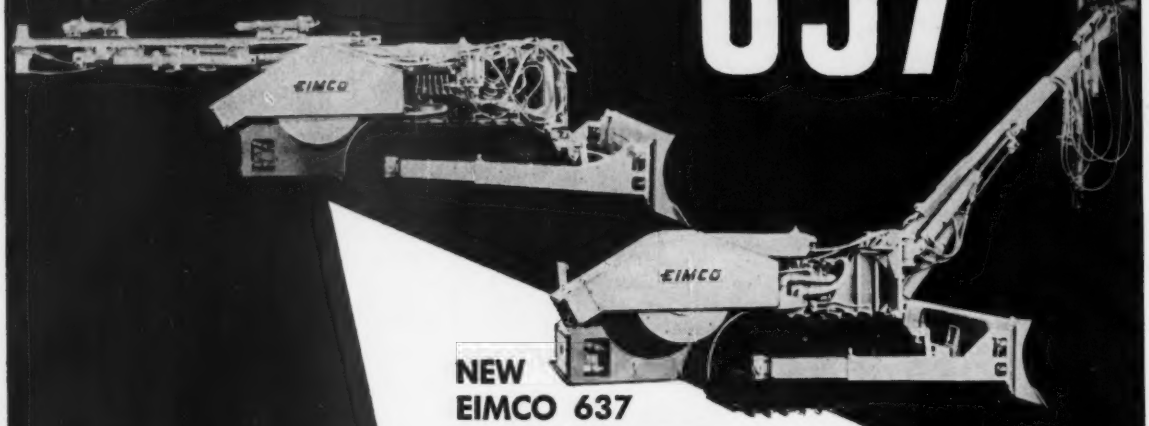

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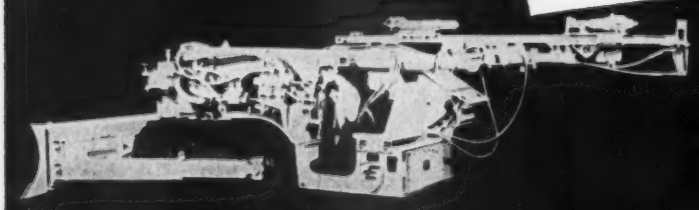

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B-393

Nevada *(Continued)*

until operations resume. Housing is being furnished free of charge to those who wish to remain. Before stoppage, gravel was being treated at the rate of 10,000 yards daily.

Apex Mineral Corp. stockholders have halted plans for construction of a new uranium mill near Austin, despite the earlier approval by the AEC. Action was taken at a meeting in Reno during February when it was learned that plans for financing the project were too indefinite. Officials agreed to seek new financial arrangements to be presented to the stockholders at a later date. In the meantime ore from the Apex uranium mine near Austin will be sent to the Lakeview Mining Co. mill at Lakeview, Ore.

Hoops Construction Co. and Pumice Inc., both of Twin Falls, Idaho, have announced plans for developing a diatomaceous earth deposit four miles east of Carlin in Elko county. A lease-option has been taken on the Pruett claims near the old Triolite plant just off Highway 40. Investigation by geologists from the Mackay School of Mines recently showed the presence of high grade filter material in the area, and the extent of the deposit will be determined by the leasers early in the spring. Bill Hoops, president of the construction firm, said that if the potential looks good enough, the two leasing companies are ready to invest $2-million for a treatment plant and operations.

Eagle-Picher's new $2.5-million diatomaceous earth processing plant at Colado in Pershing County operated at one fourth capacity during the winter months while work continued on construction of a new road to the company mine, and while Eagle-Picher officials developed new markets. Some shipments to European buyers have already been made, and Ralph Yocum, superintendent in charge, feels confident that production will be stepped up during the coming months. Laboratory tests at the new plant have been satisfactory, and Wells Cargo Inc. announces that they will complete the new road by July 1. The Colado plant has a capacity three times as large as Eagle-Picher's other Nevada plant at Clark Station in Storey County.

Fibreboard Paper Products Corp., San Francisco, has announced discovery of a large gypsum deposit on company-owned property near Apex.

Company officials say the deposit contains over three-quarter billion tons of high grade gypsum rock. There is no overburden covering the gypsum, officials say, so mining costs are expected to be among the lowest in the U.S.

Major installations at the mine site will be an 8.5 mile high-speed private trucking road from the mine to the mainline of the Union Pacific, a crushing and sizing plant, as well as hauling and access road construction and power and water supply installation at the mine itself. The projects will be completed in August. The mine will supply raw mate-

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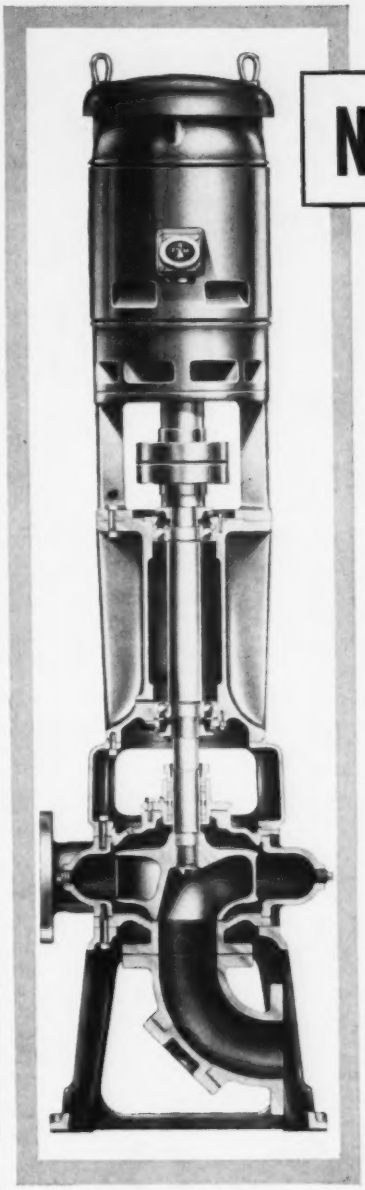

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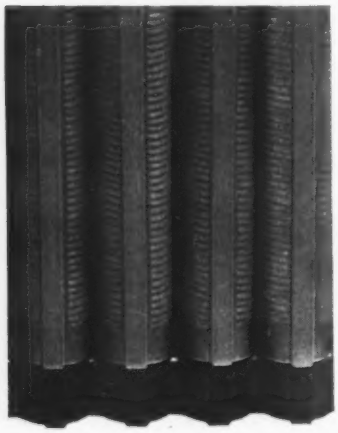

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Nevada *(Continued)*

rials for Fibreboard's South Gate, Calif. gypsum plant, where the company will construct a new 45,000 ton-per-year plaster mill and increase gypsum board manufacturing capacity by 60%.

A twin of the South Gate plaster mill is under construction at the Florence, Colo. gypsum plant west of Pueblo, where the company has gypsum raw materials deposits and mining installations. Other mines are at Henderson and Lovelock.

Removal of waste material from the Tonopah King mine at Tonopah has been completed and made possible the production of a much better grade of ore to be sent to the U.S. Milling & Mining Co. mill at Silver Peak. Grab samples from 30 cars in a recent shipment averaged 37 oz of silver and 0.45 gold. Officials of USM&M Co. are confident the grade can be maintained, and are making efforts to step up production.

Workmen in the Ohio Mine at Goldpoint, Esmeralda County, uncovered a pocket of high grade hornsilver on the 800-ft level during February. Assays on it ran 829.4 oz of silver, and 0.6 gold. The property is being developed under direction of U.S. Milling & Mining Co., and ore is treated at the firm's mill at Silver Peak. Discovery of the high grade aroused hope that there may be a high potential in the Ohio, which is already producing a steady output of ore averaging $63.50 per ton.

Carl and Gene Reinecke, of Littlerock, Calif., have purchased the Gold Pocket mine in Nye County from Lou and Phil Myers, of Tonopah. The property lies on the east slope of the Toiyabe range at an elevation of 7,000 ft and has been a good producer of gold-silver ore. The Reinecke brothers also bought an adjoining claim from Kenneth Rodgers, of Sparks, and plan to start work on repairing the road and developing the mine late in the spring when snow is melted at the 7,000-ft level.

Possibility of bringing power from Bonneville Dam into northern Nevada has brightened the prospects for continued operation of the Cordero Mine, one of the nation's largest producers of mercury. Cordero, which employs 80 men at its mine and plant in northern Humboldt County, is faced with decreasing profits due to the falling market price and high cost of power generated at the site. Sen. Alan Bible (D. Nev.) has notified the Department of the Interior he will press for an appropriation to begin construction of the Redmond-Burns transmission line. Such a line would provide Bonneville power to the Harney Electric Cooperative at Burns, Ore., which in turn would serve the northern Nevada area, including the Cordero mine.

Index-Daley Mines Co. is producing a steady output of good lead-silver-copper ore from its property in the Spruce Mountain district 45 miles southeast of Wells in Elko County. Operations were started three years ago, and five men

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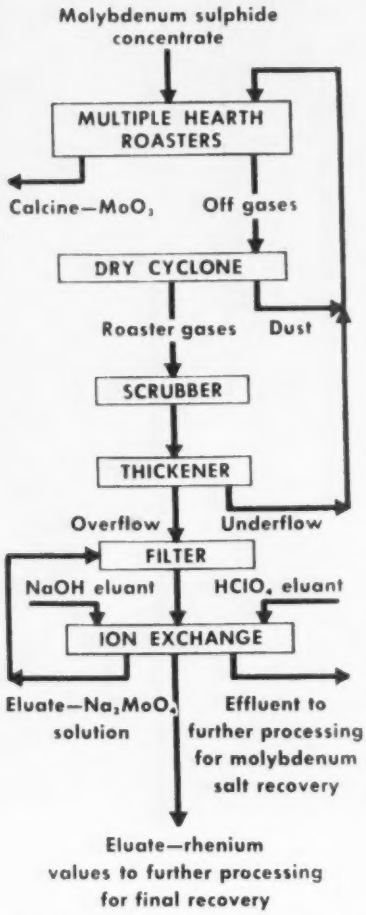

Producing Wrought Rhenium
Chase Brass & Copper Co.,
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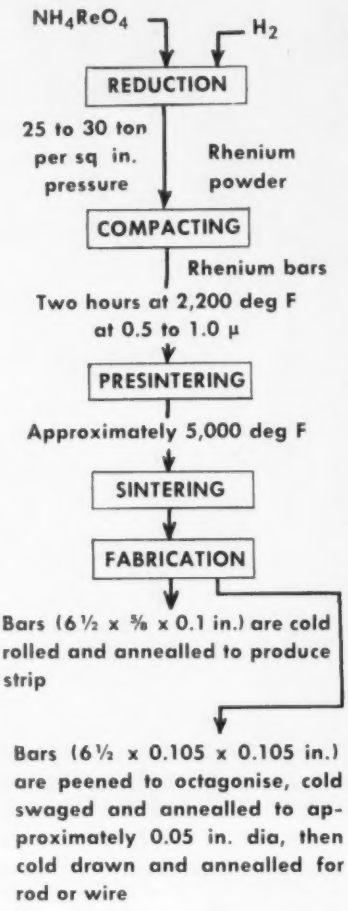
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KENNECOTT'S mines will furnish rhenium concentrate for Chase's refinery. Processes will resemble the flowsheets shown above. Many firms currently produce rhenium, but Chase will be the first to offer wrought rhenium commercially.

Chase Brass to Make Wrought Rhenium

COMMERCIAL PRODUCTION of wrought rhenium rod, wire and strip is to start shortly at Chase Brass & Copper Co., a Kennecott Copper Corp. subsidiary. Rhenium will be concentrated at Kennecott's western operations by ion exchange from the moly roaster off-gases as shown in the accompanying flowsheet. After further concentration, a purified rhenium salt (NH_4ReO_4) will be delivered to Chase's research and development department at Waterbury, Conn. to be refined to powder by hydrogen reduction, then compacted, sintered (5,000 deg F) and fabricated (see flowsheet).

Chase says that it is the U.S.'s only commercial producer of wrought rhenium (the University of Tennessee has for years supplied rhenium powder and many companies are producing wrought rhenium for their own consumption). Rhenium occurs with molybdenite, which offers an almost unlimited supply in the U.S. through the huge reserves in moly, as well as copper, ore deposits.

High melting point and electrical properties of rhenium metal have brought the metal to the fore in the missile age. The melting point is 5,756 deg F, second only to tungsten. Thermocouples of rhenium and tungsten are used to measure temperatures to 4,500 deg F. Rhenium shows some promise as a welding material for molybdenum and as a substitute for platinium as a relay contact material due to rhenium's high wear resistance.

Nevada *(Continued)*

are now employed at the site. Ore is trucked to the railroad siding at Wells for shipment to Utah for treatment and smelting. George A. Rich, of Wells, is superintendent.

Pete Peterson and associates are producing large tonnages of good silver-lead ore from their mines in the Potosi District near the old camp of Candelaria in Esmeralda County. Ore is trucked to Mina where it is loaded on Southern Pacific cars for shipment to the smelter in Selby Calif. Values run above $75 per ton, and shipments average several carloads per month.

NEW MEXICO

United Western Minerals, new processing mill in northern Taos County, went into operation in late January. Present for the occasion were a group of United Western Minerals and the subsidiary United Perlite officials and board members.

With less than 5% of its claims test drilled the new perlite company has known reserves of high grade perlite to keep its mill operating for a minimum of 20 years. With a rapidly expanding market for the light-weight aggregate and almost unlimited supplies of ore, Edward J. James, president of United Perlite expressed great optimism for the future of his company.

The new mill is designed to produce between 200 and 250 tons of perlite in an eight hour shift and has been constructed with the idea of continuous operation in mind so that it may be operated three shifts a day if desired.

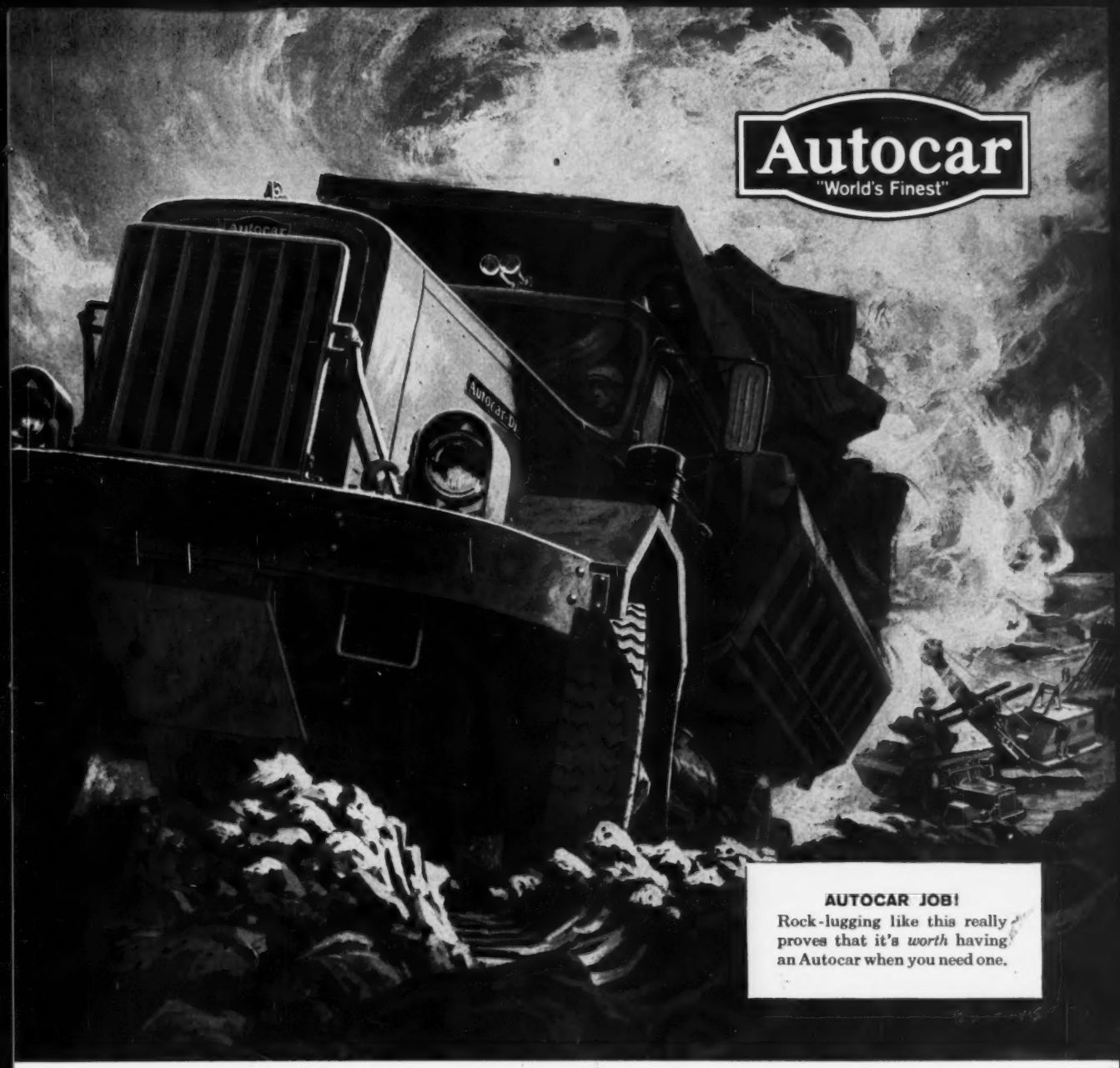
NORTH CAROLINA

Texas Gulf Sulphur Co. has obtained a five-year option on lithium mining properties of Basic Atomics, Inc., in North Carolina, the agreement including a five-year option on patent rights on a new process for the recovery of lithium from spodumene-bearing ores and concentrates.

Fred M. Nelson, chairman of Texas Gulf Sulphur, said the company "plans to investigate further the mining properties and to initiate engineering and economic studies of the new recovery process."

UTAH

Cerro de Pasco Corp., in joint venture with Armet Co., Salt Lake City and Chief Consolidated Mining Co., Eureka, is exploring the old Holt mine near Enterprise, Iron County for high grade silver.



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Utah *(Continued)*

Preliminary drilling to date has indicated a substantial deposit of silver ore in quartz fissure running 30 oz to the ton, according to mining engineer Samuel S. Arentz, who heads Armet Co. Arentz is manager of the exploration project.

Miners are now sinking a 250-ft, two compartment exploration shaft. Drifting and cross-cutting off of the shaft will be carried out in exploration. Exploration core drilling from the surface will continue.

If the property six miles north of Enterprise proves up sufficient reserves, the joint venture group will construct a cyanide mill for reduction of the ores, Arentz said.

The ore contains low values of lead and zinc.

The Holt mine has a history dating back to 1896 when a miner by that name made original locations. The property was subsequently acquired by the late Heber J. Grant, a president of the Church of Jesus Christ of Latter-day Saints at Salt Lake City.

A Cincinnati group started sinking a small shaft end to conduct further exploration in early 1930's, but depressed metal prices made this venture unsuccessful.

On death of the LDS leader, the mine and patented claims were willed to the Enterprise Ward of the LDS Church, from which religious group Mr. Arentz purchased the properties in October 1958.

Shattuck Denn Mining Corp., after a record shaft sinking, has initiated regular shipments of uranium ore from mining property leased in San Juan County. The initial ore production indicated a uranium grade of .45% to .50% U_3O_8. **(E&MJ,** December 1958.)

Last year Shattuck Denn acquired the uranium property on a long term lease from Kerr-McGee Oil Industries and Anderson Development Corp.

All uranium ore extracted from the mine will be sold to the Kerr-McGee Oil Industries and shipped to its mill at Shiprock.

Shattuck Denn is a leading producer of lead and zinc, with its principal mining property, the Iron King Mine, in Arizona. The Iron King Mine operated continuously during the year on a profitable basis despite depressed prices.

There is evidence that Superior Oil Company of California is developing a major potash bed at depths of between 2,000 and 2,200 feet in the Lisbon Valley area of northern San Juan County.

The firm has made no public statement of its discoveries and is in the process of acquiring additional potash permits. It did announce plans for a third coring program on a Federal potash permit, however, necessary to conversion of the permit to an active, operating lease. It already had finished a second hole, where it was reported to have pulled core disclosing high-grade beds in Section 17, Township 30 South and Range 25 East.

High Grade Results in Low Grade Ore

Two Marion 4161 machines are helping to point the way to high grade recovery of low grade ore in the Lake Superior region.

The diet of these machines is a hard, abrasive Jasper formation weighing 2.6 tons per yard. The Marions work on 40 foot benches in blasted pits ranging to 100 foot depths which may eventually reach 500 feet.

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This efficiency is attributable to a complete balancing of all tabling factors—head motion, underconstruction and riffling. Even its deck puts 75% more effective working riffles in the natural path of the pulp flow. The material bed is fanned out for more accurate cutting. Concentrates are of the highest grade. There are fewer middlings for circulation, making room for more tons of new feed per day and reducing wear and tear on the circulating equipment.

For complete information, send for Bulletin 118-C.

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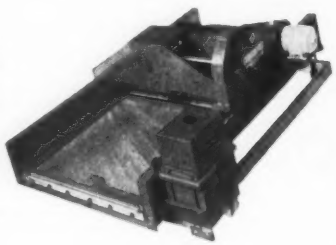
All New Model Leahy® screens utilize proven differential vibration that snaps oversize wedging particles loose 1600 times per minute. When dust is a problem, totally enclosed models are most effective. For damp screening, FlexElex® electric heating of the screen jacket insures full-time open mesh. For efficient wet screening, CONCENCO® spray nozzle arrangements are your answer.



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Utah *(Continued)*

The new well is significantly located a good two miles to the southeast of the test in Section 17.

The area is some 20 miles or more south of the Cane Creek anticline in Canyon of the Colorado River where Delhi-Taylor Oil Corp., Dallas, Tex. already has blocked out a high-grade potash ore body at 2,000 ft capable of feeding a mill at rate of 1500 tpd for 40 years.

Station is being completed and equipment placed underground for start of a 6,000-ft exploration project in search of copper ores in the properties of New Park Mining Co. in Utah's Park City district.

Robert L. Cranmer, firm secretary, said the project, financed in part by loans from the former DMEA, would probe for ores on the mine's 2,000 ft level.

Col-U-Mex Uranium Corp. expects a $500,000 return on gross mining basis from its joint venture with Standard Uranium Corp. in Utah's Big Indian district during 1959.

T. F. Herrington, Albuquerque, N.M., Col-U-Mex president, said in interim report on the firm that for the six months ended Dec. 31, 1958, the firm had gross ore sales of $213,397 and a net profit of $67,969 from these operations.

He expressed confidence that room for reduction of Col-U-Mex ores would be found in mills in the area which have contracts pending for expanded purchase of concentrates running into 1966 with AEC.

WASHINGTON

Bear Creek Uranium Co. has completed a drilling program at its Mount Spokane property and crews are now sinking a winze at the site.

A substantial orebody, largely autunite, has been established by the holes, which were drilled to depths of 60 ft, according to Frank Birch, mining engineer for the firm.

Bear Creek has shipped about 600 tons of ore to Dawn Mining Co.'s mill at Ford, Wash., during the fall and winter, officials said. Another 200 tons in stockpile will be shipped in the next month or two.

Pend Oreille Mines and Metals Co., Spokane, reported a net loss of $122,088 after writeoffs and income taxes. This compared with a loss of $138,752 for the year before.

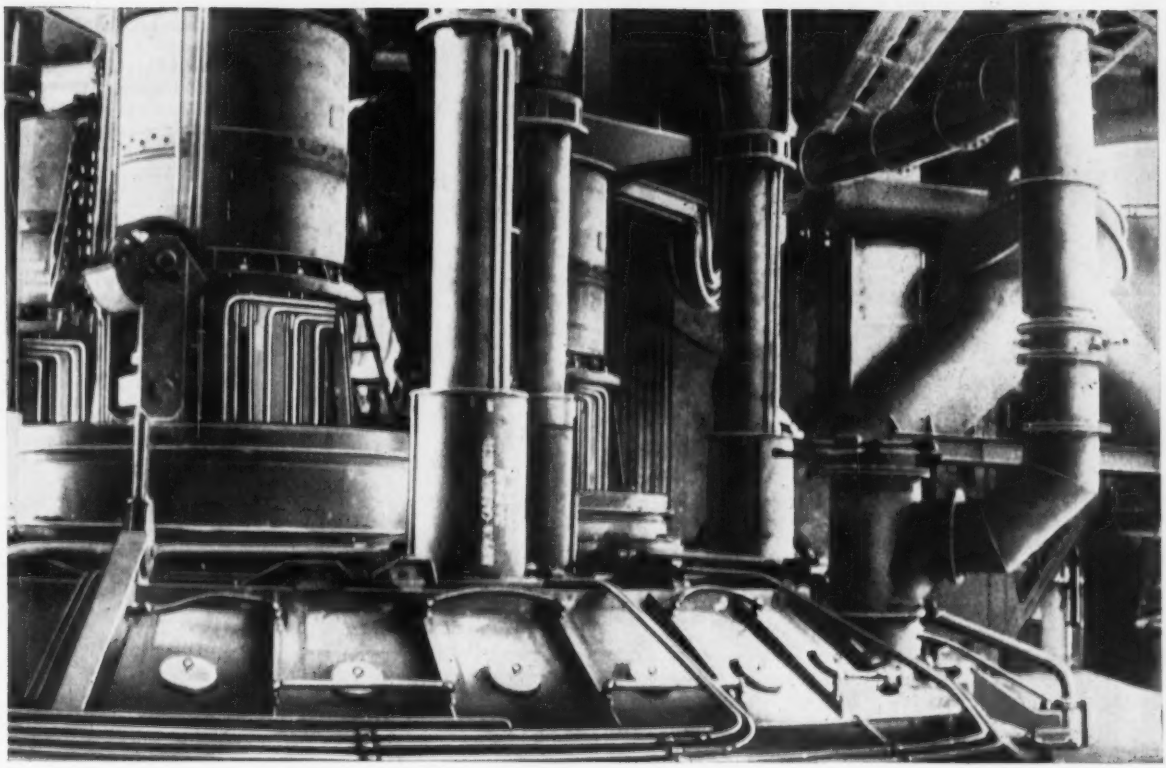
The company had income of $347,548 before deductions for depletion, depreciation and amortization that totaled $515,102. In 1957, income was $328,973 and deductions totaled $526,382.

Pend Oreille reported that during the year it milled 607,695 tons of zinc-lead ore at its operations near Metaline Falls. This compared with 757,197 tons the year before.

Concentrate production by Pend Oreille produced income of $2,107,567

98% gas recovery
from completely covered, sealed-so-tight

LECTROMELT-DEMAG ELECTRIC SMELTING FURNACES



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Gas-tight passage of movable electrodes through the roof forms a friction-free seal . . . so effective that 98% of valuable furnace gases are recovered. Roof lifting gear makes start-ups and inspection of interior furnace conditions easier. Retractable feed chutes regulate mix level of charge . . . furnace operates as efficiently at reduced as at full loading.

And now these and many other exclusive advantages of Demag design are available from Lectromelt . . . America's outstanding producer of electric furnaces. This unmatched Lectromelt-Demag combination of skills affords way-ahead efficiency, economy and safety in electric smelting furnaces.

For help in meeting any furnace requirement, contact Lectromelt Furnace Division, McGraw-Edison Company, 322 32nd Street, Pittsburgh 30, Pennsylvania.

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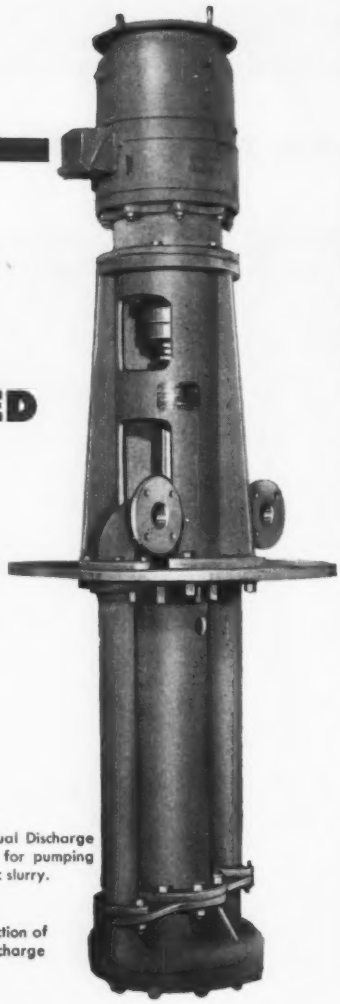
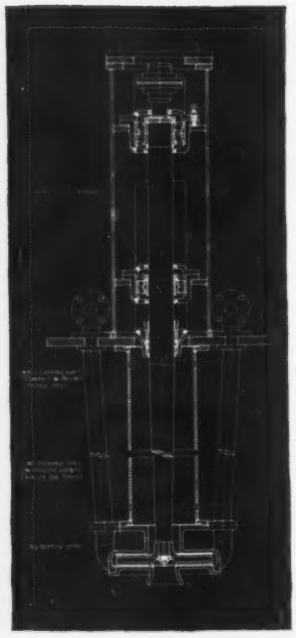
VERTICAL PUMPS WITH NO SUBMERGED BEARINGS FOR PUMPING ABRASIVE CORROSIVE SLURRIES





2" Dual Discharge Pump for pumping caustic slurry.

Cross section of Dual Discharge Pump.

This rugged type of service calls for advanced design: — extra heavy shaft, double-ported casing to equalize the side thrust of the impeller, and tough abrasion-corrosion resistant alloys. The dual discharge pump illustrated here incorporates these features and dispenses with bearings or packing below the cover plate where they would be in contact with the liquid.

Difficult pumping problems, particularly in the process industries, have been our specialty for ninety-one years. Perhaps we can be of help to you. Write us — no obligation.

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For complete information about Lawrence Slurry and Sludge Pumps write for Bulletin 207-4.

371 MARKET STREET, LAWRENCE, MASS.

Washington (*Continued*)

last year compared with $3,008,578 in 1957. The company received dividends of $180,624 from interests in the Reeves MacDonald mine at Remac, B.C., compared with $182,283 in 1957.

Kromona Consolidated Mine, Inc., of Seattle, has acquired all the assets of Victory Mines Corp., including the Kromona mine, according to Joe F. Krom, president. Kromona has resumed development of the molybdenum property, says Krom, and current development is showing encouraging results.

An incorrect account of the property appeared in *E&MJ* February 1959, p 150.

WYOMING

The AEC raw materials division has approved Western Nuclear Corp.'s contract for additional uranium milling capacity.

The go ahead was given by AEC for signing of the contract at the AEC's Grand Junction operations office.

Stockholders of Western Nuclear have approved a $7-million financing plan, submitted by president Robert W. Adams.

Under the program, $1-million will be used for expansion of the mill at Jeffrey City, $1.5-million for mine development, and $2,750,000 to retire present debt. The remainder will be added to the firm's working capital.

Western Nuclear has awarded the contract for expansion of its Split Rock uranium mill at Jeffrey City to Western-Knapp Engineering Co., of San Francisco, Adams announced.

The mill expansion, authorized under a recently negotiated AEC contract, will increase the mill's capacity to 850 tpd. Design capacity of the present mill is 440 tpd. Ore is treated by the acid leach resin-in-pulp ion exchange process.

Fremont Mining and Manufacturing Corp., a newly organized firm, has announced purchase of a gypsum mine four miles south of Lander.

The company will produce soil conditioning products, according to Ray L. Atwood of Riverton, president and treasurer.

San Francisco Chemical Co., 50% controlled by Stauffer Chemical Corp., has acquired an additional 15-million tons of phosphate rock in the Crawford Mt. area, according to D. L. King, Montpelier, Ida.

Mr. King, resident manager for San Francisco, said that 15 patented claims in the area five miles south of the Leefe, beneficiation plant of the firm, were purchased from the old United States Phosphate Co.

San Francisco previously had acquired (in 1952) ten claims in the area. In all, the claims contain some 15-million tons of phosphatic material. These claims are in the "high country" which will necessitate mining only during summer months.

Announcing

THE NEW BUCYRUS-ERIE

30-R

Here's a small sample of the big performance features the new Bucyrus-Erie 30-R rotary blast hole drill offers.

Big Capacity — Drills 6¼ to 7⅞-in. holes with rotary bits and down-the-hole tools.

Terrific Pull-Down — Hydraulic motor exerts a pull-down force of 30,000 pounds.

Infinite Selection of Speeds — Hydraulic rotary drive can be varied from 0 to 110 rpm.

Fully Self-Contained — With five lengths of pipe in its rack, the 30-R is always ready to move in and drill to a depth of 106 feet completely on its own.

Works Fast and Steady — Top drive permits continuous drilling for more than 21 feet before adding new pipe.

Always Solid, Always Level — The 30-R stands firmly on large, 20-in.-wide crawler treads . . . levels instantly with three big hydraulic jacks.

It's another OUTSTANDING B-E drill with the same rugged stamina . . . the same operating ease and servicing convenience that have made larger Bucyrus-Erie rotaries the most popular in the field — *by far*. The 30R may also be truck-mounted.

Write Dept. 2B59A, Bucyrus-Erie Company, Drill Division, Richmond, Indiana, for complete information on the new 30-R.

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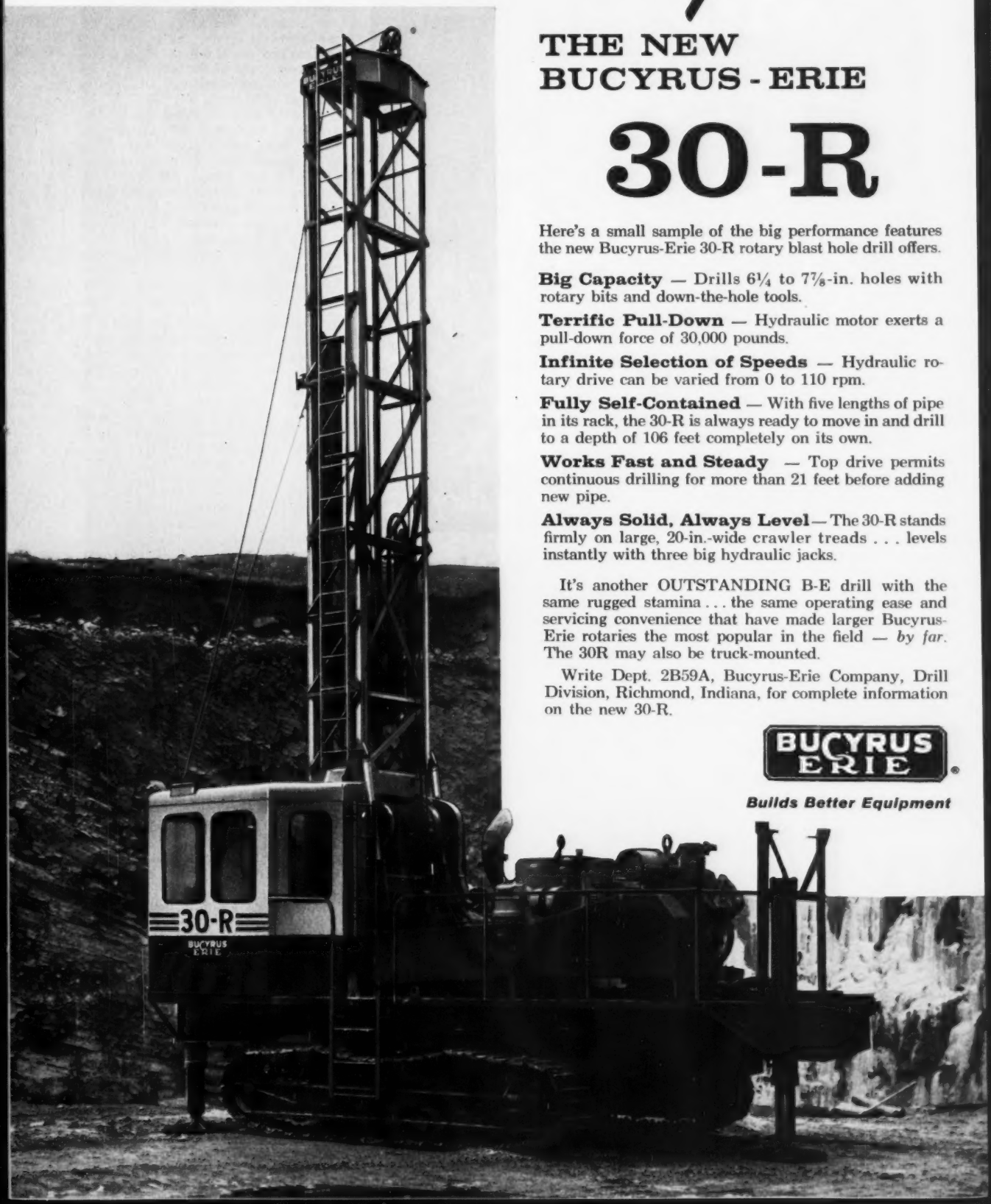
Builds Better Equipment



In the largest underground mine in the United States, over 70% of the daily production of 28,000 tons of molybdenum ores — more than half of all the moly this side of the iron curtain — is hauled in Card Granby type cars built to Climax specifications.

These are the largest and heaviest cars of this type we have built . . . designed to withstand unusually rugged loading conditions plus the wear and tear inflicted by a cleanout machine (also a Card product).

CARD car engineering results in large savings to many of the major ore producers of the world with cars built to special order at little more than the cost of standard stock models. CARD engineers are happy to consult on any haulage problem. No obligation.

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IN CANADA

NEWFOUNDLAND

Initial results of check drilling on the asbestos property of Advocate Mines near Baie Verte have substantiated former estimates and have suggested improvement in grade. Final results in volume and grade will not be available until completion of the present program which will carry through the coming summer.

A pilot plant is being erected for assessment work with bulk samples obtained from two shallow shafts. The main deposits are: the north orebody, 11,421,200 tons grading $10.50 per ton; the west body, 8,518,100 tons averaging $9.67 per ton; and the south zone, 5,501,300 tons grading $9.10 per ton.

Canadian Johns-Manville is managing present operations with other participants including Patino of Canada, Amet Corp. and Financiere Belge de L'Asbeste-Ciment, S.A.

Iron Ore Co. of Canada and Labrador Mining & Exploration are jointly planning an extensive program for their Wabush Lake iron concession in Labrador. During the coming season eight drill rigs and three mapping and sampling parties will work on the Carol deposit. 80,000 ft of diamond drilling is proposed.

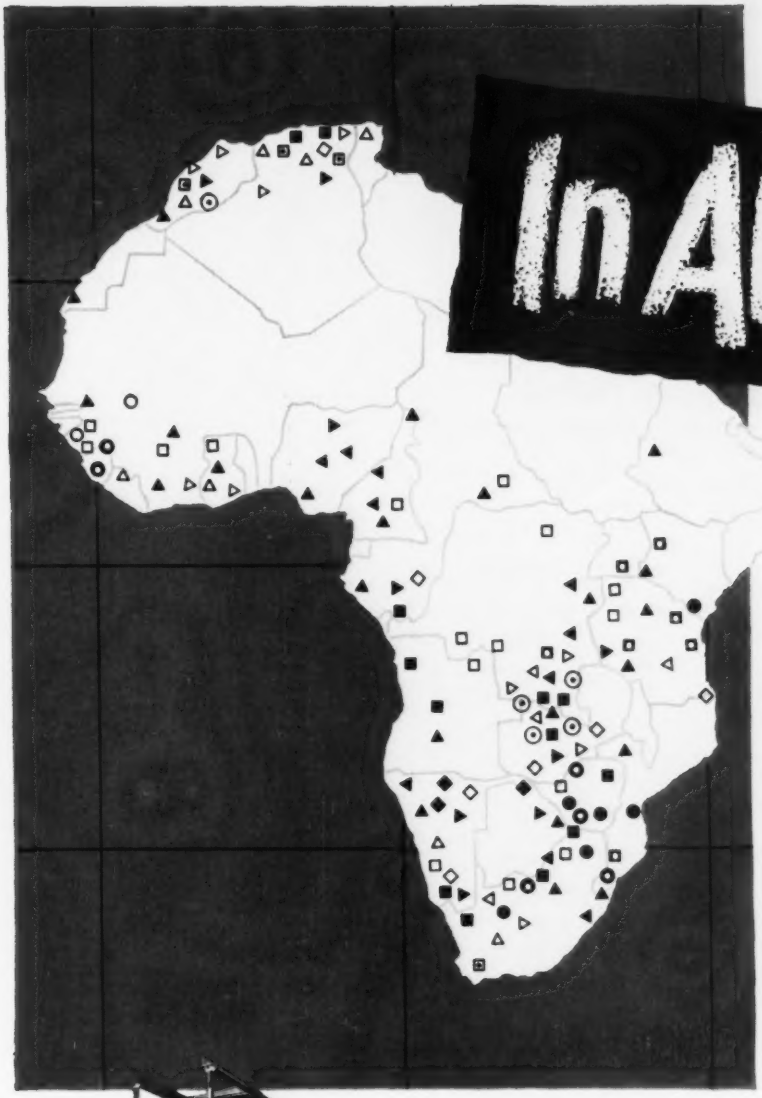
Several major deposits of concentrating iron are known to be located within a 40 sq mile area. The Carol East deposit alone is estimated to contain over 400-million tons of concentrating ore analyzing 35 to 40% Fe. A 100-tpd capacity pilot concentrating plant will be operated this summer for testing purposes.

ONTARIO

Aunor Gold Mines substantially increased ore reserves during the past year at its gold mine in the Porcupine area. Reserves at the end of 1958 are 976,000 tons, averaging 0.37 oz gold per ton, compared with 843,000 tons, grading 0.374 oz, last year. During 1958 236,106 tons, averaging 0.362 oz gold per ton were treated. Mill rate was boosted from approximately 530 to 727 tpd in the final quarter of 1958.

Consolidated Denison Mines is milling about 6,300 tpd at its uranium mine in the Elliot Lake area. Present schedule calls for monthly rate of 180,000 tons. All concentrate is shipped as produced. Over $200-million worth of uranium precipitates is called for under the company's contract with Eldorado Mining and Refining, with $55-million delivered by the end of 1958.

Campbell Red Lake Mines is making arrangements to deepen the shaft at its Red Lake area gold mine 1,000 ft to a new depth of 3,240 ft. Seven levels will be established below the present bottom



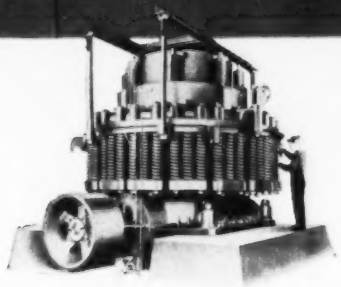
. . . SYMONS® CONE CRUSHERS

used for efficient reduction of ores and minerals

(Partial list of Africa's ores and minerals. Symbols indicate location of important deposits.)

● ASBESTOS	▶ LEAD
○ BAUXITE	▷ MANGANESE
◘ CHROMIUM	◘ MICA
⊙ COBALT	⊞ PHOSPHATES
■ COPPER	◀ TIN
□ DIAMONDS	◁ URANIUM
▲ GOLD	◆ VANADIUM
△ IRON	◇ ZINC

. . . as well as aggregates, cement rock, gravel, etc., for the construction industry.



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. . . The machines that revolutionized crushing practice . . . **are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

In all of the great ore and mineral operations around the world . . . there has been no record to equal the performance of Symons Cone Crushers in consistently and efficiently producing great quantities of finely crushed product at low cost.

In Africa, hundreds of Symons Cones are used by leading producers of most of the ores and minerals found in this giant continent. As an indication of its mineral wealth, it is significant to note that Africa produces almost 75% of the world's cobalt, 65% of its gold, 50% of its antimony, 33% of its manganese, chrome and phosphates, 25% of its copper, 15% of its lead and tin, a large part of its uranium and practically all of its diamonds.

The use of Symons Cone Crushers in Africa is another example of the way in which these efficient crushers serve the mining and mineral processing industries of the world.

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SAUERMAN NEWS briefs

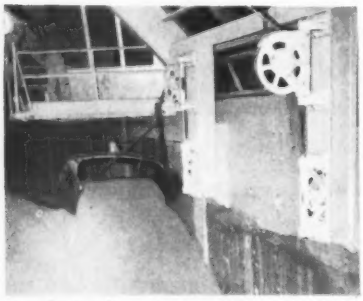
SAUERMAN BROS., INC.,
626 South 28th Avenue, Bellwood, Illinois
Linden 4-4892

Stockpiling Zinc Residue

Zinc residue from the smelting furnaces of the Meadowbrook Corporation is economically handled by a DragScraper storage machine. About 100 tons of residue are produced daily in the refining processes and the material is carried by belt conveyors to the disposal area. The conveyors feed a swivel spout which forms the initial pile near the head post.

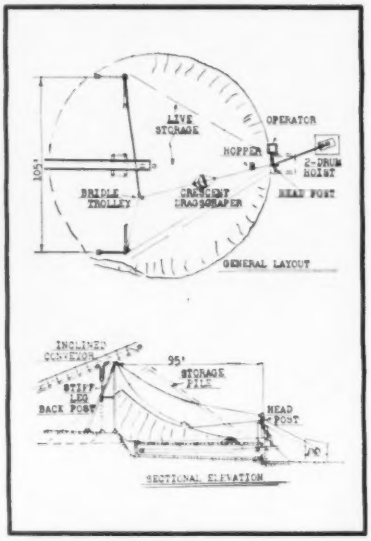
Ample storage capacity is provided by using an elevated bridle system at the outboard side of the disposal area. The elevated bridle cable is supported by two 60-ft. guyed masts about 200 ft. apart. Lateral shifting of the DragScraper is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The height of the mast permits building a 50-ft. high pile and provides storage for 100,000 yds. of zinc residue for each setup of the tailmasts.

(*Condensed from Sauerman News No. 152.*)



Reclaiming Material to hopper from all sections of a 500-ft. warehouse, the estimated operating cost of this DragScraper Machine is 2.1 cents per ton. (*Sauerman News 145*).

Rapid Shifting DragScraper is Engineered to Needs of Silica Sand Producer



The Sauerman Method was successfully applied to the requirements of a prominent silica sand producer, as shown in the drawing above. This Rapid-Shifting DragScraper Machine reclaims raw sand from a 6,000-ton stockpile.

The pile is formed by an inclined conveyor leading from the floor of the quarry to the live storage area. The Crescent DragScraper reclaims from storage to a hopper-fed conveyor in front of the head post.

Before the DragScraper was installed, the raw sand frequently bridged across the hopper. Such interruptions in the flow of raw sand to the plant resulted in costly shutdowns. The Crescent prevents this bridging action and provides a steady flow of material for processing.

The Sauerman Method also permits the company to build up a reserve pile of raw sand sufficient for at least one week's production as insurance against a quarry shutdown.

(*Condensed from Sauerman News No. 147.*)

MORE NEWS AND INFORMATION

Issues of Sauerman News giving greater detail about the installations on this page are available on request. For full information, tell us your interest or requirements and ask for catalog. Contact Sauerman Bros., Inc., 626 S. 28th Ave., Bellwood, Ill.

Ontario *(Continued)*

level, the 14th, at 2,240 ft. At present there are no plans to increase mill capacity, maintained at 700 tpd.

MacLeod-Cockshutt Gold Mines and Consolidated Mosher Mines have concluded an agreement whereby MacLeod will bring the Mosher gold mine in the Little Long Lac area into production. The plan calls for production rate of 2,000 tpd. Mosher adjoins MacLeod on the west and MacLeod workings are already up to the Mosher boundary on at least five levels. Mosher's service shaft, which goes to 2,530 ft, can be used. Previous work on the property developed positive reserves of 4-million tons on four levels averaging 0.155 oz gold per ton with additional large tonnages indicated at depth and to the west.

A new staking rush has developed following extensive aerial geophysical surveys in an area 40 miles northwest of Sudbury. Over 300 claims have been staked to date and crews are still active. The area is described as a greenstone belt in which copper, lead, nickel, and zinc mineralization have been reported. Surveys covered an area 20 miles long through the northern portion of Hess, Moncrieff, Craig Twps and Twp 115, and through the southern portion of Ulster and Munster Twps. Thirty-two anomalous areas were indicated.

Pronto Uranium Mines had gross revenues of $12,220,000 from its uranium producing mine in the Elliot Lake area in 1958. This represents an increase of $1,150,000 over the previous year. A total of 549,976 tons was milled for average revenue of $22.21 per ton, against 507,122 tons for an average of $21.82 per ton in 1957. Operating costs increased from $11.37 to $11.92 per ton.

Algoma Ore Properties, veteran iron producer in the Michipicoten range, marked up a new production record in 1958. Shipments of iron concentrates totaled 1,577,220 tons against 1,513,849 tons in 1957. Outlook for the current year is even better with shipments expected to reach 1.8- to 2-million tons. The company's new Sir James open pit mine is now in production at more than 4,000 tpd. Major depth development at the Helen mine, designed to open a block of 50-million tons of ore for mining, is now nearing completion.

Cleveland Copper Corp. announces that the company has acquired a block of leases in the Lake Erie field, aggregating approximately 44,000 acres, located about 10 miles south of Pointe aux Pins. The ground appears to be located near the crest of a broad arched structure which trends southwesterly through southwest Ontario and across Lake Erie. In all probability the full range of formations from the Devonian down are present.

The company expects to start exploration work as soon as weather permits. Field work will be under the supervision of J. J. Rankin and R. L. Segsworth of Ranworth Explorations Ltd.

ANNOUNCING TWO NEW LIMAS

TYPE 64

1¼ Yd. Shovel
40 Ton Crane
13'3" Long Crawlers
10'8" Wide Crawlers
With 30" Treads

TYPE 64-SC

SPECIAL CRANE
50 Ton Capacity
17'1½" Long Crawlers
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With 42" Treads

- Easily converts in field for use as shovel, crane, dragline, clamshell or pullshovel
- Crawler, truck or wagon mounting available
- Choice of gas or diesel power—with torque converter
- Lima's precision air control lets operator work all day without tiring

Newest Lima, Type 64—shown here with 22-ft. boom, 18-ft. handle, 1¼-yd. dipper. 2 and 2¼-yd. coal loading dippers available.

The rugged new Lima Type 64 fills a definite need for a heavy duty 1¼-yd. shovel, 40-ton crane, dragline and 1¼-yd. pullshovel that will combine dependable high performance with low maintenance costs, for maximum profit! The new type 64-SC with extra long, wide crawlers is designed for special crane service. This new Lima has a capacity of 50 tons on a 40′ boom at 10′ radius.

Lima Quality Features

You get these, and many more, Lima quality features in the 64 and 64-SC: precision-machined teeth on heat-treated alloy steel gears; long-lasting, trouble-free anti-friction roller bearings; safe, sure band brake and jaw clutch power steering; splined shafting; extra-large-diameter hoist, crowd swing and propel clutches; independent planetary boom hoist.

Crawler truck base is strong one-piece alloy steel casting with integral machined ring gear and flame-hardened roller path. Rotating base is one-piece carbon steel casting, built to absorb severest shocks of hard digging. Center pin is relieved of strain by six hook-type conical rollers tapered to revolve naturally around double-flanged roller path.

Like all Limas, the 64 and 64-SC are good travelers. Strips down easily for haulage. Side frame assemblies, complete with treads, are simple to remove. Ledge mounted, one-piece rear counterweight can be easily removed. When equipped for crane service, folding or telescoping gantries can be lowered to cab height for low clearance.

Designed to Outperform

Service is easy, every part readily accessible. Simplicity of power transmission design lessens friction, reduces upkeep, and delivers more power. Torque converter prevents engine stall, cushions shocks to operator and machine, increases performance by building up line pull.

Learn more about the Type 64 and 64-SC, newest members of the Lima family of high-performance construction equipment —The Lima line includes shovels to 6 cu. yd., cranes to 110 tons, draglines variable. Write or see your Lima distributor now.

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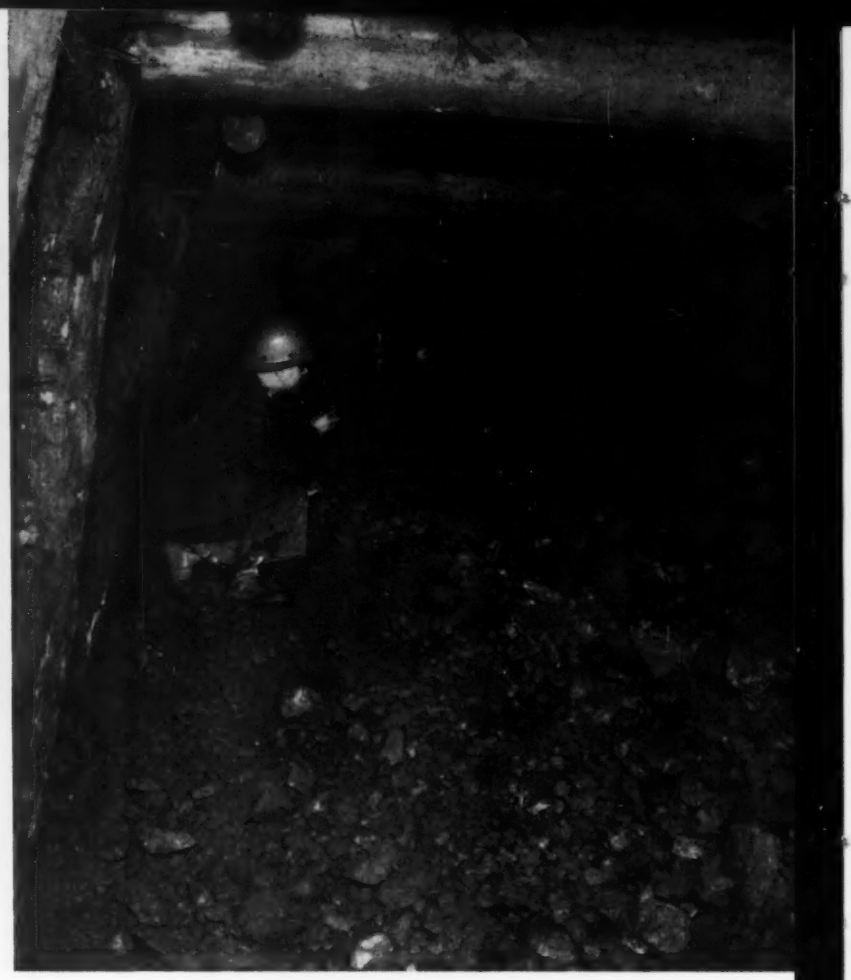
WELL-BROKEN ORE resulting from blast with new, economical Du Pont explosive.



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Now you can realize the substantial savings of Du Pont HI-CAP® in your underground work.

Formerly available only in larger diameters, HI-CAP was so well received that we have developed 3 new grades in small diameters (2" and less).

Low-cost, versatile • The versatility of the complete line of this low-priced, quality explosive now offers substantial savings by its use in all types of shooting under all but the most severe conditions.

Field reports: high quality • Shot reports show that you sacrifice nothing in quality to get the economy of HI-CAP. It gives excellent fragmentation and good fumes. The denser grades have shown good water resistance.

Available now • Your Du Pont Sales Representative will be glad to arrange a trial or give you more information.

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GRADE	STICK COUNT*	WATER RESISTANCE
HI-CAP 1	120	Good
HI-CAP 2	135	Fair
HI-CAP 3	150	None

*1¼"x8" cartridges per 50 lbs.

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...THROUGH CHEMISTRY

Ontario (*Continued*)

MORE COMBINATIONS

FOR MORE STOPING SITUATIONS

3 hard-hitting models

2 roof-pinning stopers

A combination of feeds, chucks and controls to match every stoping problem

Take your choice of three powerful Gardner-Denver stopers: the versatile, lightweight Model R68; the rugged, mediumweight Model RB94; or the heavy-duty Model RB104.

All three are outstanding in their class for high performance and low maintenance.

They're easier to handle . . . have balanced weight distribution. You may choose the feed control most suitable to your operation.

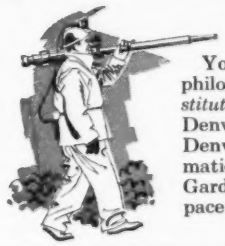
For roof bolting, specify a Gardner-Denver RB94 or RB104 roof-pinning stoper. They handle all operations quickly and efficiently—drilling hole, driving stud, tightening nut.

Gardner-Denver R68

Gardner-Denver roof-pinning stoper

Choose the right stoper combination for your work

Model	R68	RB94	RB104
Hammer diameter	2⅛"	2¾"	3⅛"
Direct feed (steel)	X	X	X
Direct feed (aluminum)	X	X	X
Telescopic, direct feed (aluminum)	X	X	X
Reverse feed	..	X	X
Collared chuck	X	X	X
Tappet chuck	X	X	X
Push-button control	X	X	X
Rotary control	X	X	X
Stop rotation control	X	X	..
Roof-pinning adaptations	..	X	X



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Ontario (*Continued*)

As soon as the snow is off the ground, the company also expects to commence a ground geophysical or electromagnetic program on its holdings in the Eastern townships of Quebec.

Canadian Charleson Co., Ltd., which is operating on a gravel containing about 15% iron, made its first shipment—about 39,000 tons—from its property near Atikokan, Ontario, in 1958. The jig plant produced a very satisfactory product.

Lowphos Ore, Ltd., subsidiary of National Steel Corp., and operated by the M. A. Hanna Co., will begin production at its Ontario property in early April. The mine is at Moose Mountain, 35 miles north of Sudbury. Little work was done at the mine in 1958 because of the lessened demand for iron ore. The plant has a capacity of 550,000 tons of concentrates per year to be shipped as fines for sintering.

QUEBEC

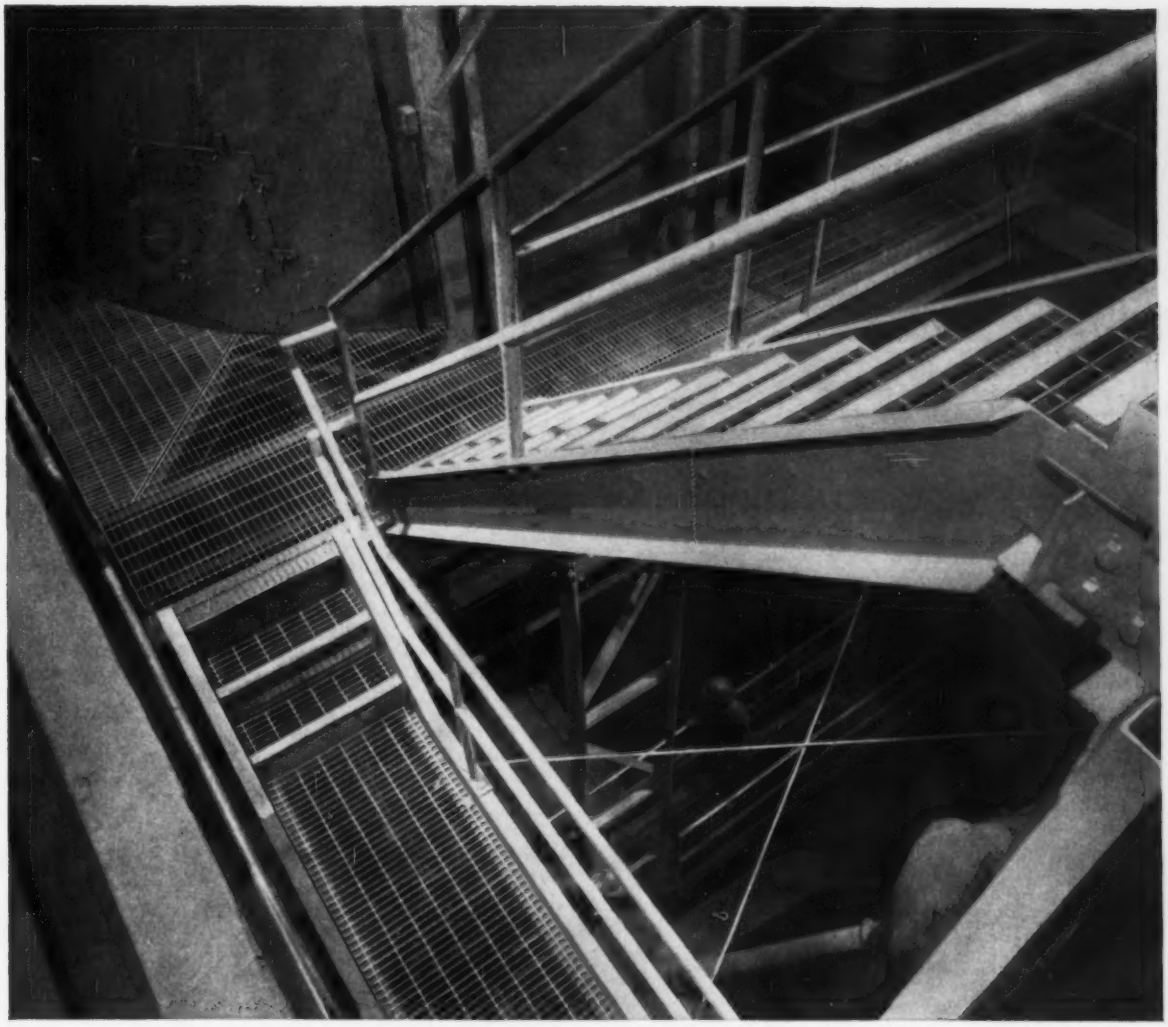
Diamond drilling on the Ungava nickel concession of La Compagnie Miniere de l'Ungava (Cominga) during the past year encountered copper-nickel mineralization over a length of 4,000 ft. Combined copper-nickel values ran better than 1% across widths of more than 60 ft. The mineralized zone is still open at both ends.

Barnat Mines is preparing to boost production to 2,000 tpd at its gold mine in the Malartic area. The new rate follows the discovery of the porphyry orebody last year in underground development some 1,200 ft northwest of the shaft. The orebody is estimated to contain about 5.5-million tons and is still open to the west. The plan is to increase milling capacity from the present 600 to 700 tpd with an additional 1,300 tpd to be shipped for treatment at the nearby Malartic Gold Fields mill. It is expected to reach a 1,600 ton rate by July of this year and the planned 2,000 tons by about the end of the year.

Hull Iron Mines, Ltd., Ironside, Quebec, near Ottawa, is sinking a 15 deg, 1,000 ft long slope and a vertical shaft to reopen an old iron ore deposit.

The new Hilton Mines concentration plant, Shawville, Quebec, operated in 1958 with a production of about 300,000 tons. The pellets were shipped to Jones & Laughlin Steel Corp. at Pittsburgh and Steel Co. of Canada at Hamilton. Hilton Mines is owned by Stelco Mines, Ltd.—subsidiary of Steel Co. of Canada—and Bristol-Quebec Mining Co. Ltd., owned by Pickands, Mather & Co. and Jones & Laughlin Steel Corp.

Deranco Mines is undertaking an exploration program on several groups of claims staked recently in the Evans Lake area, some 70 miles north of the Mattagami Lake area. The company was formed to take over property acquired



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Quebec *(Continued)*

by a syndicate which included Ventures, Fatima Mining, Midrim Mining, Multi-Minerals, R. J. Jowsey Mining, Atlin-Ruffner Mines, Sand River Gold Mines and Osisko Lake Mines. Over 2,350 line miles were flown in aerial geophysical surveys, followed up by ground geophysical work. In all, 111 claims in seven groups were staked along a 30-mile length of a large greenstone belt stretching west from Mistassini and Frotet Lakes. Other companies in the area include Noranda Mines, Phelps Dodge Corp. of Canada, and Vermont Zinc Mines.

Seven companies under Little Long Lac Gold Mines' control have acquired some 9,000 acres in Clericy and Joannes Twps in the Noranda area. The acreage has been divided among the companies, each of which will retain any discoveries made on its own group. The ground is considered favorable for gold and includes options on two groups of about 200 acres each, on which gold was found in previous operations. Companies participating in the project are: Perron Gold Mines, Val d'Or Mineral Holdings, Hasaga Gold Mines, Consolidated Red Poplar Minerals, Hard Rock Gold Mines, Oklend Gold Mines and Pitch-Ore Uranium Mines.

New Hosco Mines has prepared revised estimates of tonnage and grade on its Daniel Twp property in the Mattagami area. Revised figures show 1.6-million tons grading 2.57% Cu in the copper zone, plus a possible 220,200 tons averaging 2.27% Cu. Estimates for the zinc deposit were upped from 716,000 tons grading 8.23% Zn to 780,800 tons averaging 8.15% Zn. Diamond drilling is being continued with three drill rigs in operation. Metallurgical test work is also in progress.

Norlartic Mines is to start ore shipments from its Malartic area gold mine in June. Initially it is expected to ship 200 tpd for treatment at the nearby Malartic Gold Fields mill with subsequent increase to 400 tons and ultimately to 1,000 tpd, if development results warrant.

The shaft program, which provides for the opening of four new levels down to the 1,000-ft horizon, is continuing. Resampling of old workings indicated an estimated 367,958 tons averaging 0.155 oz gold per ton in the main zone above the 500-ft horizon. Subsequent work has indicated an additional 325,000 tons averaging 0.173 oz gold between the 750 and 1,000-ft horizons.

Canadian Malartic Gold Mines is concentrating exploration in two promising areas. One area is in the north end of the property in the volcanic belt in which Barnat's new porphyry ore is located. The other is a known gold-bearing zone about a mile southeast of previous mine workings. The latter area has been reached by a long drive southeast from the No. 3 shaft. First drifting on the zone has opened 102 ft averaging 0.125 oz gold across an average width of 13.8 ft.

The drive has to go over 1,000 ft along strike before reaching the common boundary with East Malartic Mines. The north area has also been reached in a long drive north on the 750-ft level to the Barnat Mines boundary. Underground diamond drilling is being carried out from this drive to test the area.

Belleterre (Quebec) Gold Mines has closed down for good at Belleterre. The company has been the sole support of the town for many years. Extensive exploration in the past several years failed to produce economic ore.

Merrill Island Mining Corp., Ltd., has agreed, in principle, to mill ore from Bateman Bay Mining Co. The agreement will enable Bateman to ship up to 500 tpd, Merrill Island Mining announces.

This amount of custom ore can be accommodated at Merrill Island Mining's mill with a limited amount of additional capital expenditure, the company adds. The arrangement "will in no way interfere with Merrill Island's production program."

Bateman Bay, which recently made arrangements for funds sufficient to bring its property into production, is now assured of a mill for its ore.

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BRITISH COLUMBIA

Bralorne Pioneer Mines Ltd. is the new company created by amalgamation of Bralorne Mines Ltd. and Pioneer Gold Mines Ltd. Pioneer is to be liquidated and its shareholders will receive one Bralorne share for five Pioneer.

The merger will facilitate exploration of ore structures now provided by the two properties, help depth development, eliminate duplication, increase efficiency and lower costs, according to F. R. Joubin, president of Bralorne.

Bralorne's ore reserves as of Nov. 30, 1958 were estimated at 563,000 tons, 0.86 oz gold per ton.

The workings at Bralorne now stretch a mile below the surface and as each level is developed the ore has become richer. Pioneer has found no new ore in the last year and reserves cover less than two years' operation. Its potential appears, like Bralorne's, to be at the lower levels but it would cost more than $1-million to do the exploration.

Cascade Lode Mines Ltd. has signed an agreement with Pacific Quarries Ltd. for exploration and development of its iron ore at Zeballos. Pacific will carry out a magnetometer survey and if results justify it, conduct a diamond drilling test. Cascade plans to reactivate the White Star gold mine which was closed in 1939, and to build a mill at the property this fall.

Employees of Consolidated Mining & Smelting Co. in Kimberley, Trail, Riondel and Salmo have approved a new three-year contract providing a 23½¢ hourly wage increase. Mine-Mill Union members voted 1,850 in favor and 1,117 against. Laborers' basic pay will rise from $1.73 an hour to $1.87½ by March 1, 1961. The contract also provides for three weeks' holiday after 10 years' service and a sick leave benefit plan to become effective March 1, 1961.

Mining operations have been suspended by Yale Lead & Zinc Mines Ltd. at its property near Ainsworth. The mill is treating small shipments from other properties in the area. Exploration is planned in the spring on a 36-claim molybdenite prospect optioned by the company adjoining Canol Metal Mines, 90 miles northeast of Whitehorse.

United Keno Hill Mines Ltd. reports first quarter production ending Dec. 31 totalled 1,954,200 oz Ag, 6,018,400 lb Pb, 4,919,000 lb Zn and 60,900 lb Cd. This output established a new quarterly high for the company.

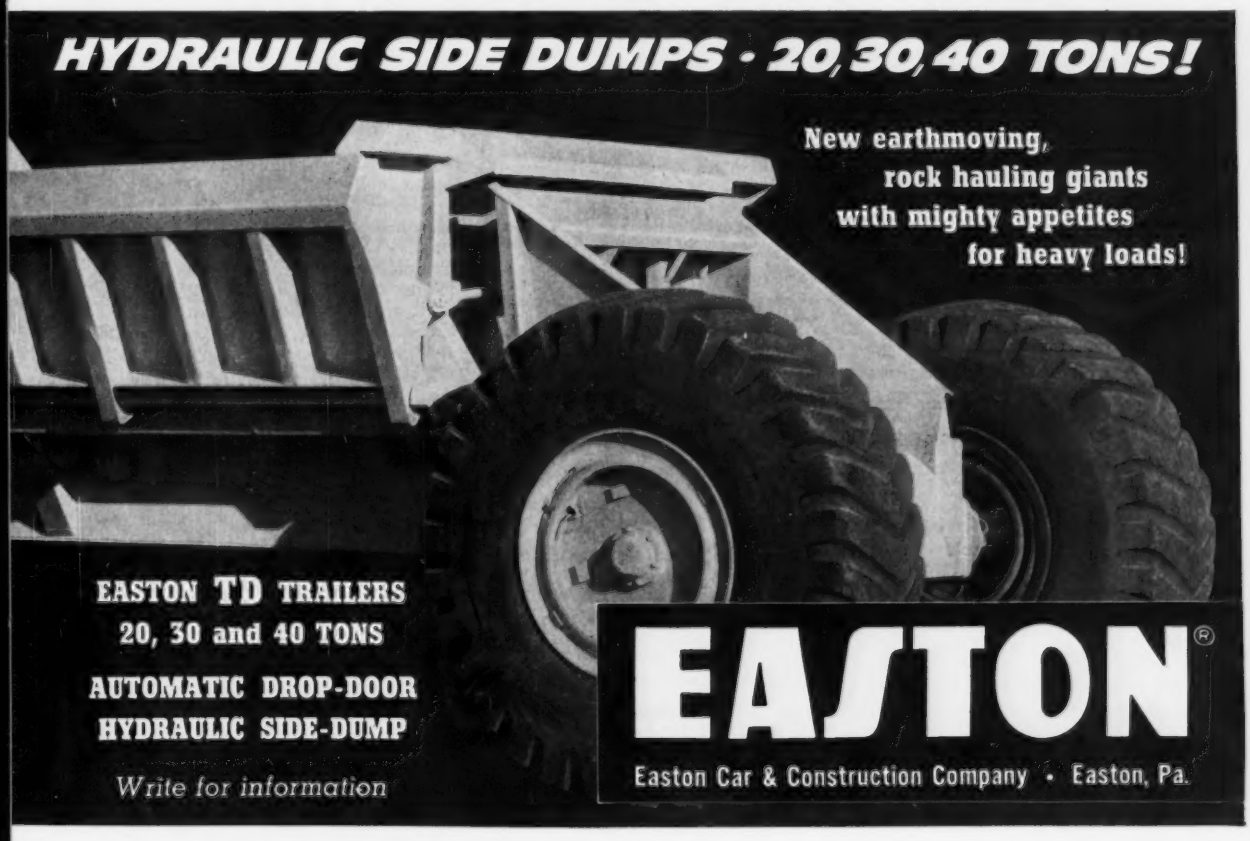
Canex Aerial Exploration Ltd. has agreed to examine and, if justified, bring into production the Gem mine property of Northern Gem Mining Corp. Ltd., now claimed to have "an unusual mineral content rich in cobalt, gold and some uranium that has now been found over a vertical range of 200 ft in what may be continuous orebodies." Twenty-eight claims, near Haines Junction, Yukon Territory, have been optioned by Canex for $6,000 cash and a total of $1,004,000 over 20 years.

A successful year just completed by Lake Cinch Mines in northern Saskatchewan resulted in a consolidated net profit of $320,007 for Violamac Mines Ltd. This is a five-fold increase over 1957. Low metal prices curtailed production at Violamac mine but development of grade silver ores was continued.

Sunshine Lardeau reports that Newmont Mining Corp. of Canada Ltd. and James Richardson & Sons have agreed to sell their interests in the firm for 19c a share. Transcontinental Resources Ltd., the purchaser, plans to operate Sunshine as a mining, oil and industrial investment company. Total assets are set at $1,025,-351.

Encouraging copper values are reported by Minex Development Ltd. on its Highland Valley property as a result of drilling by American Smelting & Refining Co. Mineralization was found in each hole over a 2,000-ft distance with hole No. 5 showing 1.5% Cu in one intersection. Minex has terminated its agreement with Asarco but plans further diamond drilling in the spring.

Giant Mascot Mines Ltd. reports a net loss of $35,243 in the fiscal year ended Sept. 30, 1958. Giant was forced to suspend production of barite from tail-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B.C. *(Continued)*

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Reserves total 700,000 tons and Giant has a contract with McPhail for all its barite production. Work on the company's Good Hope mine at Hedley may be resumed this year, and the ore milled by the adjoining French Mine owned by Cariboo Gold Quartz. Work will also be started on a placer deposit 50 miles south of Dawson where the company owns a dredge.

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The first drift running north from the main tunnel averaged 1.10% Cu for a length of 83 ft, with the last 22.2 ft running 1.62% Cu. The main tunnel will be continued to the limits of the Jersey and then another 1,000 ft to open the East Jersey zone. A smelter may be constructed jointly in the area by Bethlehem and Craigmont.

The Geological Survey of Canada has released its report of findings of asbestos and molybdenum in northern B.C. and as a result a staking race is under way. Among those staking claims are Cassiar Asbestos, Phelps Dodge Corp. of Canada, Kennecott Copper Corp. (through its subsidiary, Northwestern Explorations), Dome Mines, Moneta Porcupine Mines and Buffalo Ankerite Gold Mines.

It is understood that at least seven other major exploration groups are also in the field. The asbestos showings are in the Dease Lake area, east of Telegraph Creek and about 50 miles east of the Alaskan Panhandle. The molybdenite showings are about 40 miles south and west of Dease Lake.

The Geological Survey report is released in Ottawa, and British Columbia firms, who did not receive it until nearly a week later are complaining that they were "left at the post" in the staking race.

SASKATCHEWAN

Eldorado Mines & Refining Ltd. feels that possibilities are good for adding substantial tonnages to the company's ore reserves in the Beaverlodge uranium district.

This was disclosed in a paper presented by J. M. Douglas, assistant manager of the Eldorado's Beaverlodge operations at the annual Prospectors and Developers convention conducted by the Alberta and Northwest Chamber of Mines & Resources in late February.

Purpose of the paper was to bring delegates up to date on the Eldorado Beaverlodge operation. Eldorado was the first producer in the area, having started milling operations in early 1953.

Highlights of the paper included:

Capital expenditures to the end of 1958 have amounted to approximately $32-million for plant and townsite buildings and equipment.

Production is being maintained at 2,000 tpd, with a gross value exceeding $2-million per month. Three thousand tons of high carbonate content ore per month from Rix-Athabasca Mines Ltd. is being milled by Eldorado. About the same quantity of Eldorado ore is shipped monthly to the Lorado acid-leach mill.

Proven and probable ore reserves on Nov. 1, 1958 were 1,848,950 tons grading 0.222% U_3O_8.

It was stated that current daily production is coming from about 47 stopes. This ratio was given: Verna mine above 6th level, 30,000 tons; Ace mine above 6th level, 10,000 tons; Fay area below 6th level, 20,000 tons. It was in connection with this discussion that the good possibility of adding substantial tonnages to reserves was made known.

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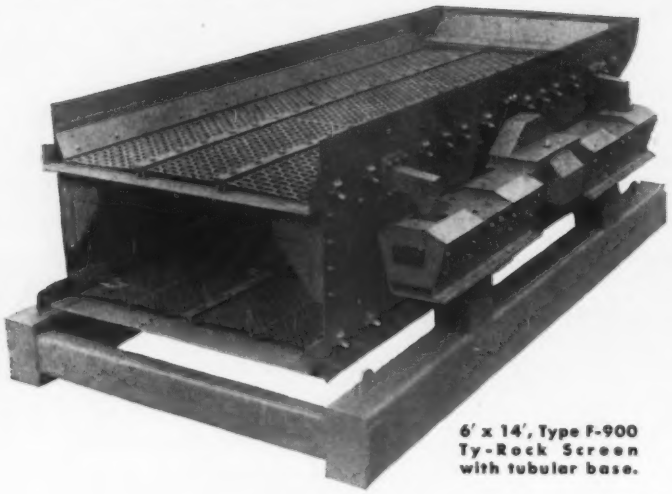

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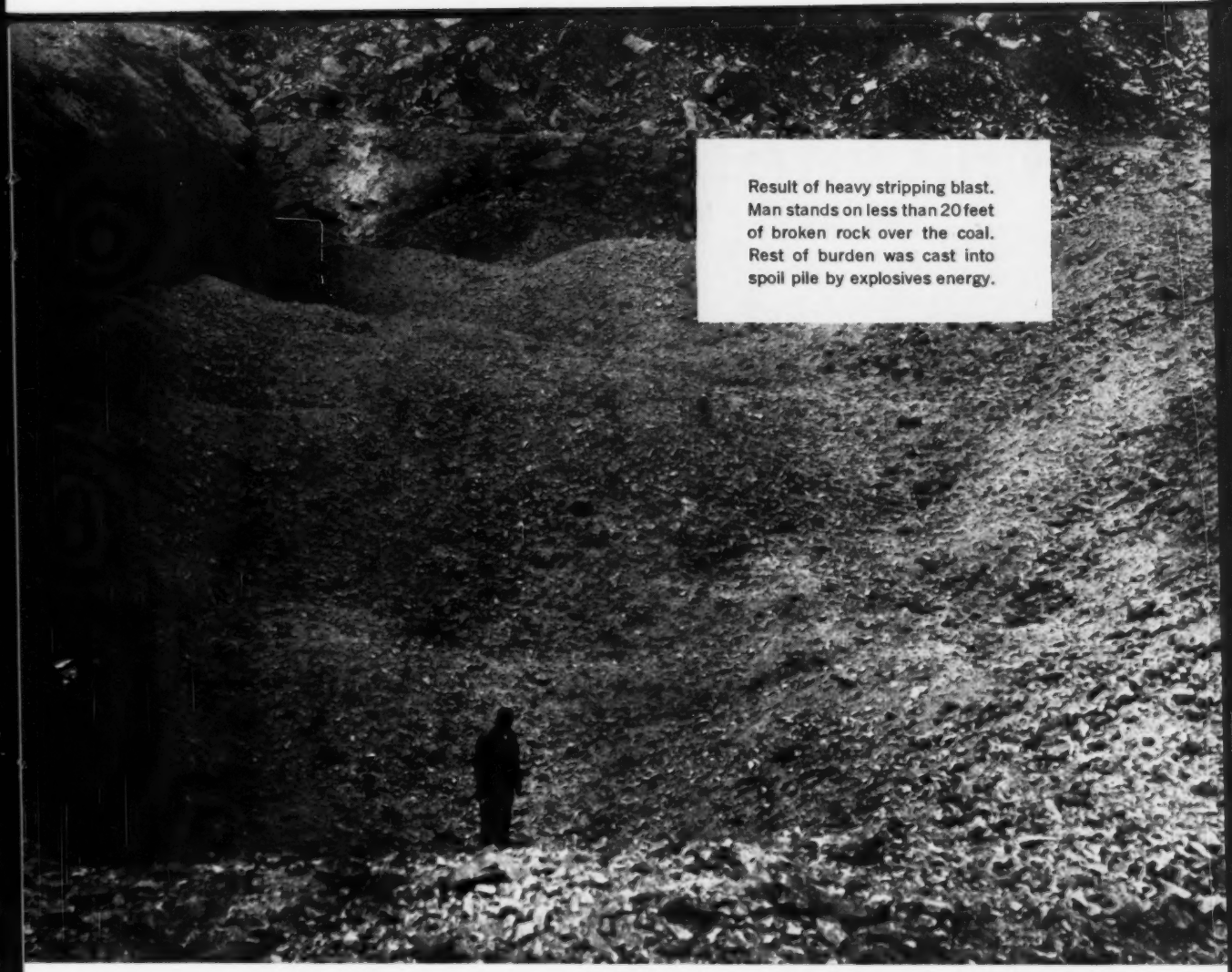

Result of heavy stripping blast. Man stands on less than 20 feet of broken rock over the coal. Rest of burden was cast into spoil pile by explosives energy.

AN OPEN LETTER TO THE COAL STRIPPING INDUSTRY

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Latest development is in northwest Pennsylvania where certain stripping operators are *proving* that, under their conditions, explosives energy is cheaper than mechanical energy in moving overburden to the spoil pile. Even though they are using 2½ to 3 times the explosives normally fired, they are saving money . . . so much they wouldn't consider going back to older methods.

Formerly, they had used about 1 lb. of blasting agent to break 2½ to 3 cubic yards of rock. The formation was dislodged from the strata, then dug conventionally with the dragline sitting atop the shot bank.

With the new method, the overburden is loaded so heavy —over 1 lb. of blasting agent per cubic yard of overburden—that up to 40% is blown across the pit to the spoil area. Remaining overburden is spread across the pit at ⅓ to ½ the height of the original bank. Following the shot, a bulldozer smooths the top of the pile, and the dragline walks out on top of the shot material.

Although some had to see it to be convinced, all three operators agree they uncover 30% more coal in a given length of time . . . that overburden is broken much better, resulting in less down time for the dragline, and considerably longer cable life. Bulldozer time for reclamation is reduced 20%.

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WILMINGTON 99, DELAWARE
Offices in principal cities

B.C. *(Continued)*

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Eldorado Mines & Refining Ltd. feels that possibilities are good for adding substantial tonnages to the company's ore reserves in the Beaverlodge uranium district.

This was disclosed in a paper presented by J. M. Douglas, assistant manager of the Eldorado's Beaverlodge operations at the annual Prospectors and Developers convention conducted by the Alberta and Northwest Chamber of Mines & Resources in late February.

Purpose of the paper was to bring delegates up to date on the Eldorado Beaverlodge operation. Eldorado was the first producer in the area, having started milling operations in early 1953.

Highlights of the paper included:

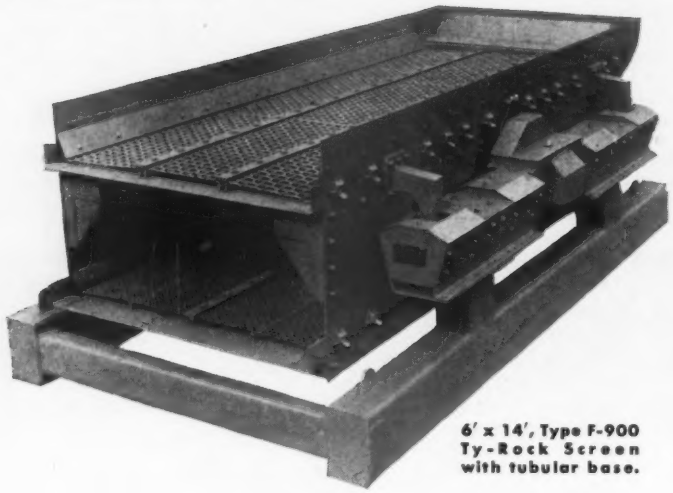
Capital expenditures to the end of 1958 have amounted to approximately $32-million for plant and townsite buildings and equipment.

Production is being maintained at 2,000 tpd, with a gross value exceeding $2-million per month. Three thousand tons of high carbonate content ore per month from Rix-Athabasca Mines Ltd. is being milled by Eldorado. About the same quantity of Eldorado ore is shipped monthly to the Lorado acid-leach mill.

Proven and probable ore reserves on Nov. 1, 1958 were 1,848,950 tons grading 0.222% U_3O_8.

It was stated that current daily production is coming from about 47 stopes. This ratio was given: Verna mine above 6th level, 30,000 tons; Ace mine above 6th level, 10,000 tons; Fay area below 6th level, 20,000 tons. It was in connection with this discussion that the good possibility of adding substantial tonnages to reserves was made known.

TY-ROCK SCREENS



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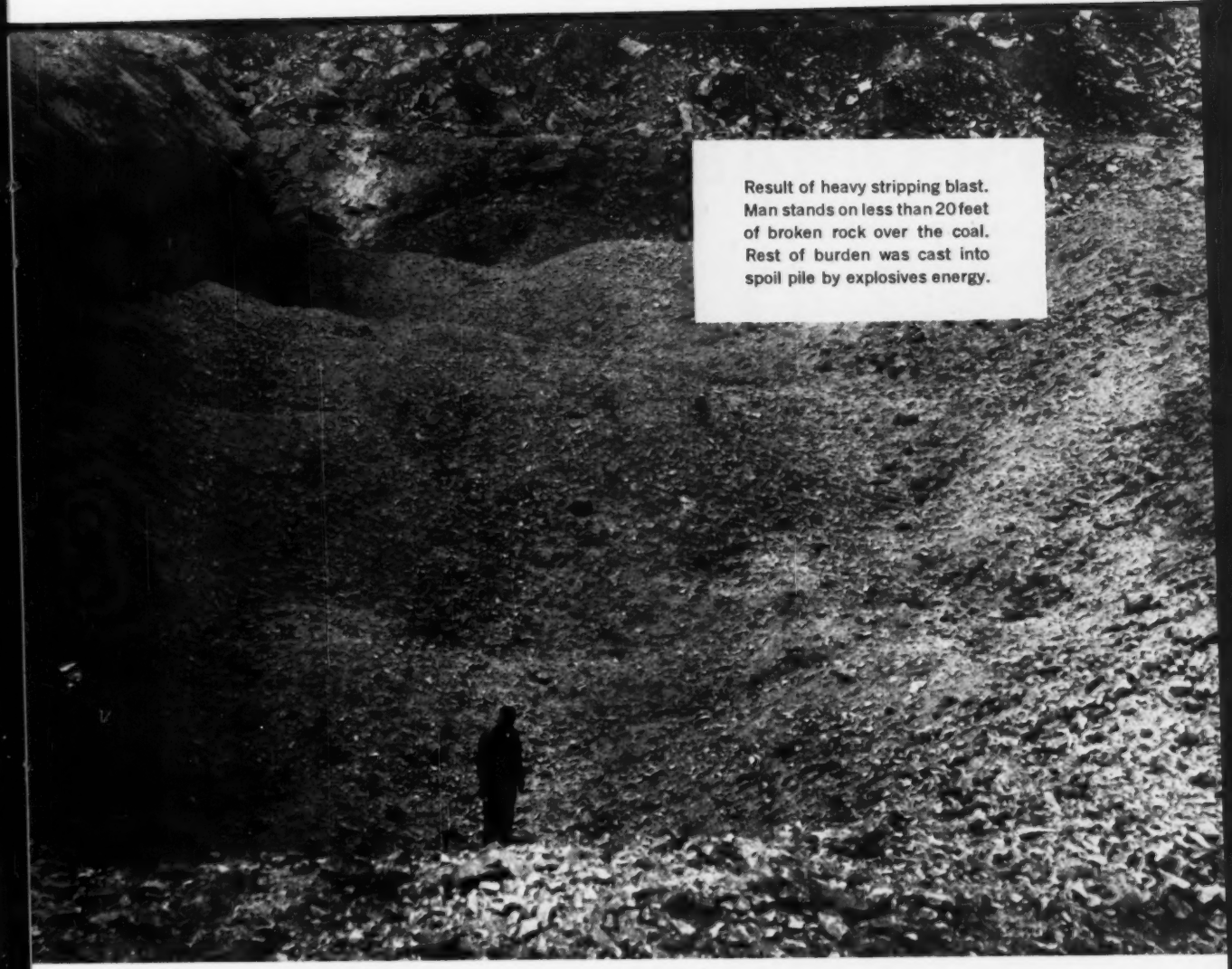

Result of heavy stripping blast. Man stands on less than 20 feet of broken rock over the coal. Rest of burden was cast into spoil pile by explosives energy.

AN OPEN LETTER TO THE COAL STRIPPING INDUSTRY

"Explosives are the cheapest labor you can hire."

Sometimes that's a hard statement to prove, but with the use of low cost blasting agents, it's making more sense every day.

Latest development is in northwest Pennsylvania where certain stripping operators are *proving* that, under their conditions, explosives energy is cheaper than mechanical energy in moving overburden to the spoil pile. Even though they are using 2½ to 3 times the explosives normally fired, they are saving money . . . so much they wouldn't consider going back to older methods.

Formerly, they had used about 1 lb. of blasting agent to break 2½ to 3 cubic yards of rock. The formation was dislodged from the strata, then dug conventionally with the dragline sitting atop the shot bank.

With the new method, the overburden is loaded so heavy —over 1 lb. of blasting agent per cubic yard of overburden—that up to 40% is blown across the pit to the spoil area. Remaining overburden is spread across the pit at ⅓ to ½ the height of the original bank. Following the shot, a bulldozer smooths the top of the pile, and the dragline walks out on top of the shot material.

Although some had to see it to be convinced, all three operators agree they uncover 30% more coal in a given length of time . . . that overburden is broken much better, resulting in less down time for the dragline, and considerably longer cable life. Bulldozer time for reclamation is reduced 20%.

This is another example of how modern methods are helping cut costs. Let the Atlas representative in your area discuss this new technique with you to see if it can be applied to your conditions.

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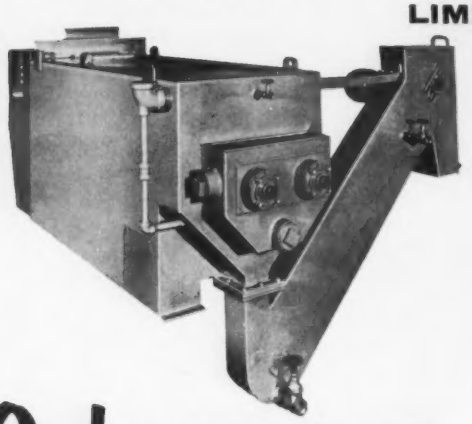

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Saskatchewan (*Continued*)

Stated the paper:

"It is expected that by year end most of the ore in the Ace mine above 6th level will have been mined out. Verna and Fay area tonnages will be increased accordingly. Active mining is in progress on levels down to and including the 11th level in the Fay area. The thirteenth level ore will be reaching the mill by year end.

"Ore discoveries on the lower levels in the Fay area have been up to expectation. Exploration in the section below 6th level at Verna will be of major interest in the next few months. Because of the irregular nature of the ore above the 6th level at Verna it has not been considered that exploration from that level with down holes would give an accurate picture of ore content. On the basis of limited information it is believed that there is good possibility of adding substantial tonnages to the ore reserves."

IN LATIN AMERICA

CHILE

El Laco iron ore deposit, frequently referred to in *E&MJ* the past several months, is located at latitude 23°51′ and length 67°27′, i.e., 280 miles by road from the port of Antofagasta and 11 miles from the Argentine border at 15,000 ft above sea level. The deposit consists of four big orebodies; Laco Norte, Laco Sur, Tuyajto Este, Tuyajto Oeste, all within a three mile radius.

El Laco, according to several geological and engineering survey reports, is estimated to have over 3-billion tons of iron ore. Quality of the ore is high with excellent chemical and physical specifications. The iron content is running from 66 to 69%. Survey studies are going on in order to determine the layout for the construction of a railroad, port and installations necessary for the exploitation of the mine.

However, for development big investments will be needed. A mining camp will have to be constructed for 10,000 persons. Approximately 400 km of railroad will have to be built, as well as a mechanized sea-port with a loading capacity of 5,000 tph. It is estimated that all this will require the investment of $250-million.

Santa Fe, which owns El Laco, is the biggest iron producing company in Chile, with an actual production of 200,000 tpm. The company has mines in Ovalle, Coquimbo, Copiapo, Caldera and Cheñaral, and recently constructed two mechanized ports in Caldera and Cheñaral, with a loading capacity of 2,000 tph.

The Mining Loan Bank and the Smelters Corp. have signed a new contract with the Norddeutsche Affinerie of Hamburg

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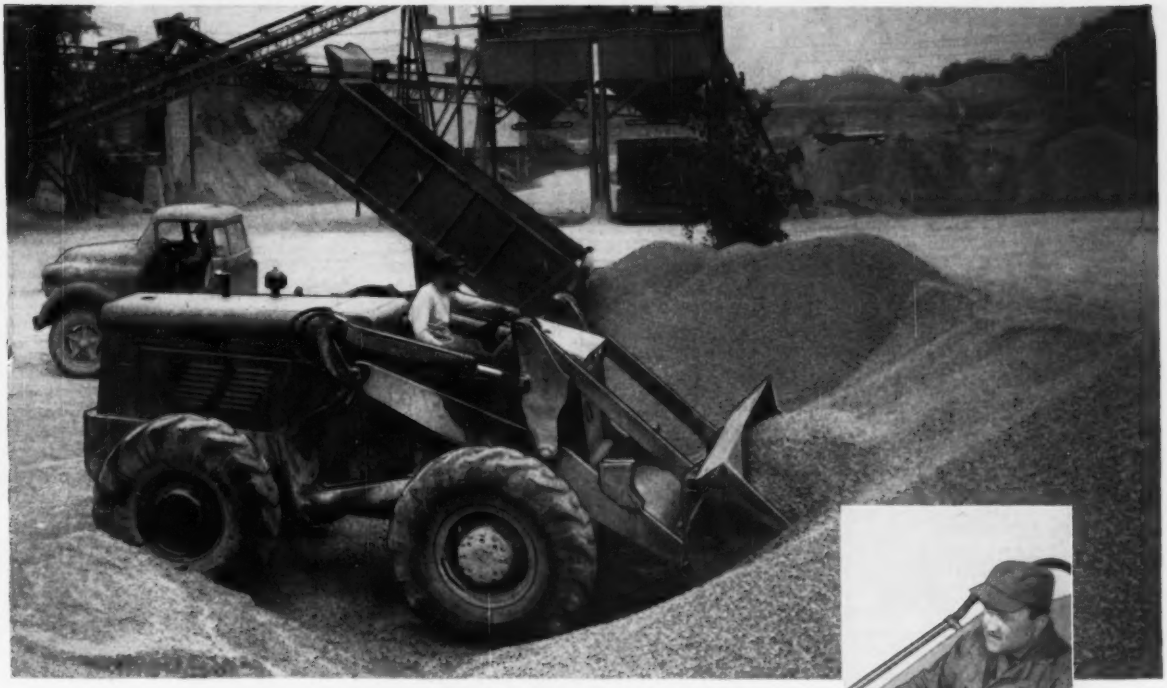

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Chile *(Continued)*

which will come into effect as of July 1 to refine copper from the Paipote copper smelter and the excess of ores the smelter can not reduce at Paipote. Advantages of the new contract over the old are a larger percentage of the blister to be electrolytically refined and delivered to the Bank (which can sell this at a higher price in the South American markets such as Brazil and Argentina or in Europe), a reduction of $6 per ton from the refining charge and a smaller interest on the money advanced.

Chile Exploration Co. should produce, in the future, over 330,000 short tons of copper per year. Chuqui employs about 5,000 men at its mine and mills which means a productivity of 400 lb of copper per man-day.

The workers of Andes Copper Mining Co. settled their strike for a 33% rise in their wages, exactly the same as the rise in the cost of living in 1958.

The present Administration is asking the United Nations to send several mining geologists to Chile to investigate the possibility of finding more orebodies in northern Chile which is yet little known from a modern geological view point. Chile will supply the local currency required for the work to be carried out with the most up-to-date methods of investigation. Now, geological studies in Chile are administered by many fiscal agencies, such as the Mining Bank, the Smelters Corp., Corporación de Fomento (Chilean RFC), Institute of Geological Investigations, Ministry of Public Works and the Geological Institute of the University of Chile.

The Paipote copper smelter has produced in its seven years of operation 114,000 short tons of blister. Last year the smelter turned out 22,000 short tons of blister which also contained 28,700 oz Au and 287,000 oz Ag, which were obtained from smelting 170,000 short tons of charge containing 16.9% Cu. Last year Paipote saved the country $2,650,000 in foreign currency.

Cerro de Pasco Corp. has sent the U.S. 10,000 tons of its milling ores from its Rio Blanco copper mine (under option) to determine the effect on river pollution of the decanted water from its projected tailings dams.

Last year 841,075 tons of high-grade iron ore valued at $11-million were exported from the ports of Guayacán and Coquimbo, Coquimbo province. Some of the ore ships loaded over 40,000 tons.

GUATEMALA

Considerable progress has been made in Bunker Hill Co.'s program to develop mineral resources in Central America. Following 14 months of preliminary exploration and negotiations operation of the company's newest exploration venture has started.

The project, located near Huehuetenango in northwestern Guatemala, began in mid-1957 when Bunker Hill joined W. R. Grace & Co. to explore possible resources in Central America. This joint venture was given the name "Camagra," a combination of Central American Mining Association and Grace.

Many months of preparatory work, spearheaded by Bunker Hill's Robert J. McRae, project manager, Charles C. Hathhorn, exploration engineer, and, for a briefer period, Blaine L. Wiseman, geologist, resulted in the discovery of several sites worthy of further examination.

The most promising site found was the Torlon mine near Huehuetenango, where for 300 years natives have been taking lead and silver from shallow-surface workings, none over 100 ft deep. The earliest mining was done for the Spanish Conquistadors, who obtained an unknown quantity of silver from the site, discarding the lead and zinc. For the last 50 years, however, it has been worked for its lead. It is estimated that some 50,000 tons of lead have been removed.

Until recently, when Camagra optioned the mine, all operations have been on a small and primitive scale.

The company's mine is being worked with the most modern equipment. Living quarters for personnel are provided and the company has constructed 12

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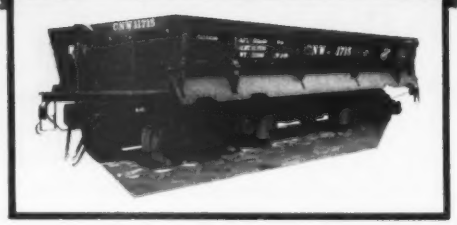

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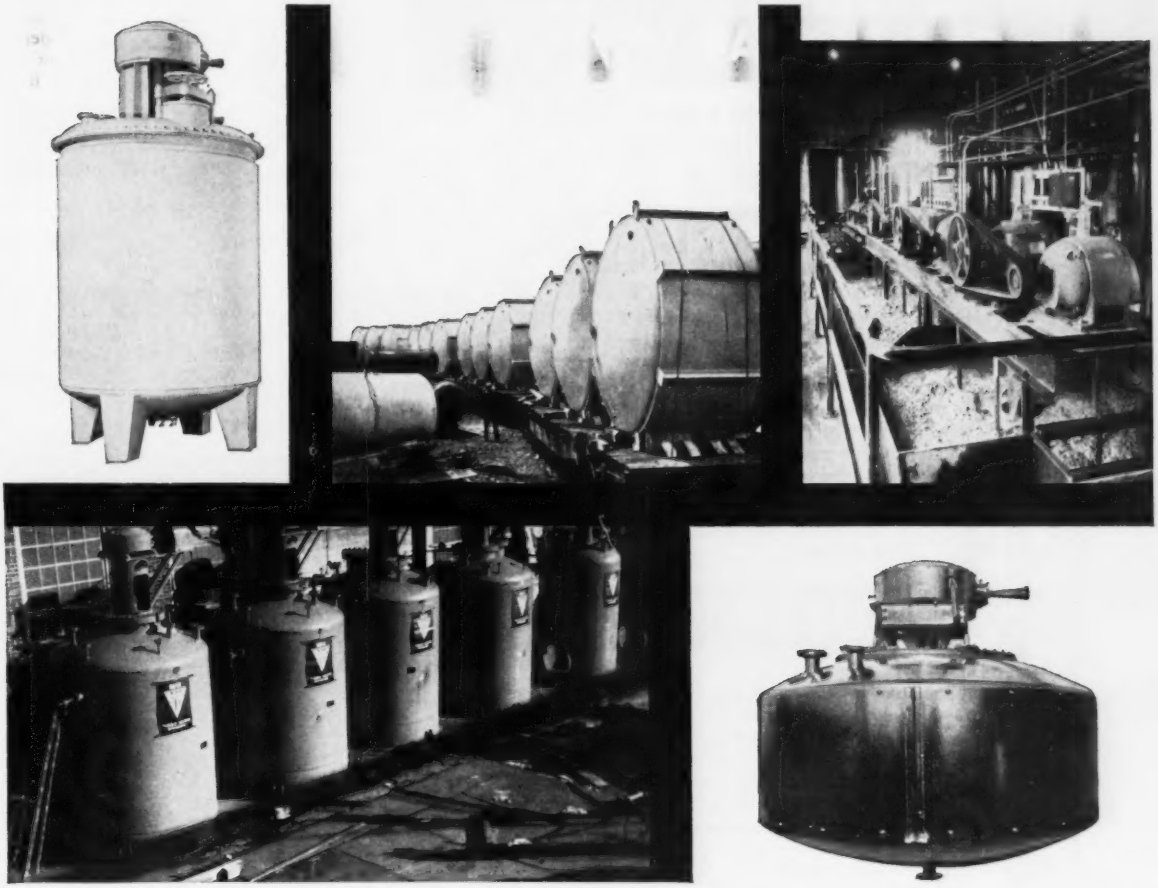

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Guatemala (*Continued*)

miles of road between the mine and the nearest city.

Camagra is driving 800 ft of drifts and raises which will cut the Torlon mineral zone considerably deeper than earlier mining. The surface area has been so gutted that it is difficult to tell what the original area might have averaged in lead and zinc. If this first phase of operations shows promise, the project will be continued and expanded.

MEXICO

Mexican sulphur production took one of its sharpest drops in a year with production off 9,000 long tons last January, compared with December. Total production was 106,266 long tons compared with 115,322 long tons in December.

The biggest Mexican producer, Azufrera Panamerican (Panamerican Sulphur) was off the greatest amount with 8,000 long tons drop. Gulf Sulphur's affiliate, Cia. de Azufre Veracruz, was slightly lowered with around 1,000 long tons drop. The rest of the local producers' (mainly Texas Gulf and Pemex) production remained the same.

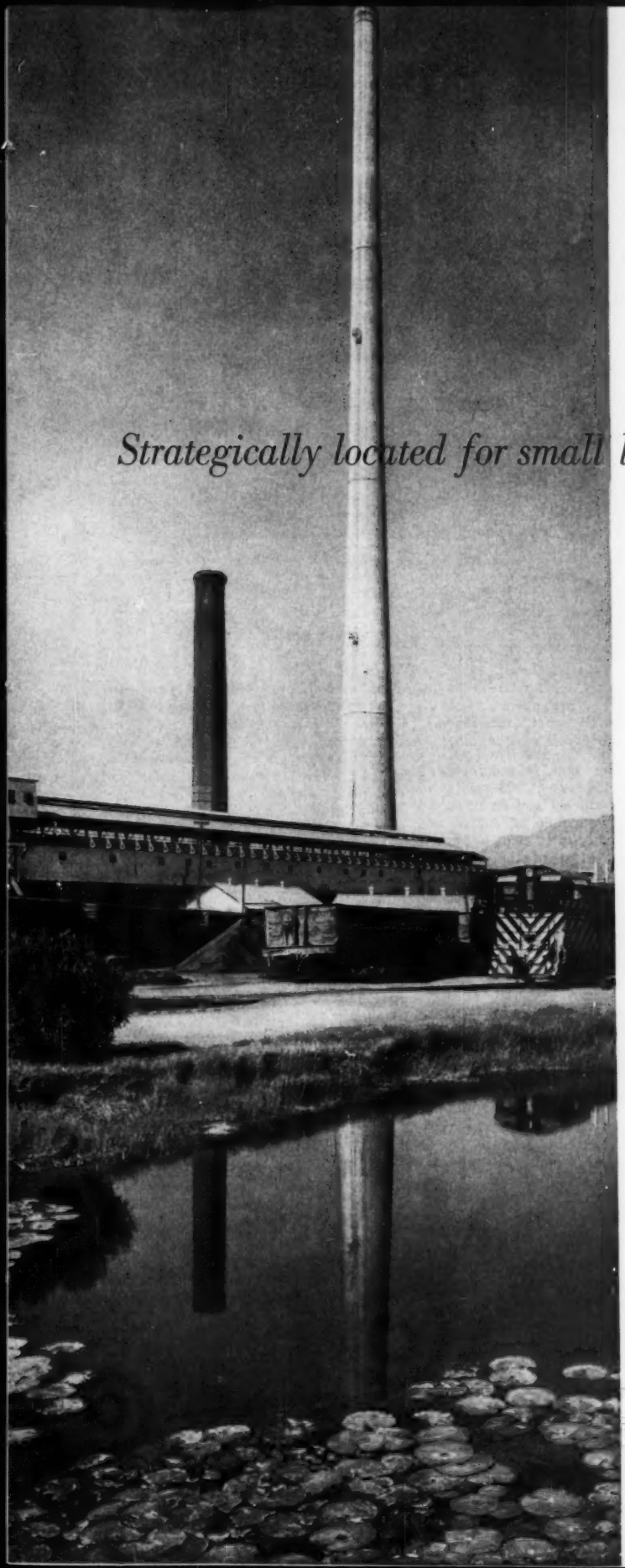
Exports were off 40,000 long tons. The slack in world demand and the husky supply of sulphur around the world were given for the drops in production and exports, according to an executive from Panamerican Sulphur.

IN THE PHILIPPINES

The following are the production figures from Surigao Cons. Mining Co., Inc.'s mines at Siana, Mainit, Surigao, for the month of February 1959: Tonnage milled, 7,600 tons; gold recovered, 1,833 oz; silver recovered, 10,000 oz; lead recovered, 60,000 lb.

Atlas Consolidated milled 316,392 tons at its Toledo mill in January with an average grade of 0.62% Cu. This represented 29 milling days operation. Copper concentrates totalled 6,442 tons, estimated to contain 3,548,500 lb of copper and 766 oz of gold. In addition, 1,000 tons of pyrite were shipped to the National Power Co. in Lanao. The January output was less than in December because of lower grade mill feed. However February showed a sharp pickup with mill heads averaging better than 0.7% Cu. From the company's iron mine in Mati, Davao, two shipments were made to Japan totalling 14,050 tons. The total value of all shipments during the month was $830,000.

January production at Lepanto Consolidated was 2,156,390 lb Cu and 3822 oz of gold, from milling 38,625 tons of ore. Average copper content per ton of ore milled was 2.95% with 0.136 oz



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58-54

ASARCO

Philippines *(Continued)*

Au. Copper recovery was nearly 95% and gold 72.8%.

Benguet Exploration Co., operating a small mill in the Baguio area, is producing about 460 oz of gold a month from milling 800 tons of relatively high grade ore. Thanks to the premium on gold in the free market in Manila, the company realizes about $70 an ounce for its bullion.

Samar Mining Co., operating a large iron ore deposit in Sibouguey, Zamboanga del Sur, proposes to install a cold reversing steel mill on the property this year, to be fed with steel produced from local iron ore. The company is controlled by Elizalde interests.

Philippine Iron Mines, largest of the country's iron ore producers, showed a profit of $1,176,000 in 1958. Deliveries of iron ore to Japanese steel mills during the year were substantially less than in 1957 but production was maintained unchanged at the company's mines with excess output stockpiled.

Good commercial manganese deposits have been reported in Lanao, Mindanao. Development work is going on by the Kapatagan Cons. Mines with some 30 men employed.

MR. EDILBERTO A. CABIGAS, head of Cabigas Mining Enterprises, shown signing contract with Suriago Cons. Co. for the operation of the former's property of high-grade iron located in Pagadian, Zamboanga del Sur. Shown with Mr. Cabigas are officers of Surigao Cons. Mining Co.—Otto F. Weber, president and general manager; (seated) attorney Felix A. Santos, assistant secretary-treasurer; and Placido Adad, treasurer (standing left to right).

A development and operating contract was signed Feb. 18, 1959 between Surigao Cons. Mining Co. and Cabigas Mining Enterprises whereby Surigao will develop and operate Cabigas' property consisting of 178 lode mineral claims located in the Municipality of Pagadian, Province of Zamboanga del Sur.

The mineral claims contain high-grade iron ore. Assays from the orebody range up to 70% Fe. In addition to the main outcrop, an area exceeding two kilometers long is covered by large "float" boulders indicating that an orebody of considerable dimensions exists in the heavily wooded hills above the float covered hillsides.

The property will be developed by Surigao Cons. Mining Co. in conjunction with the property of Pioneer Mining Corp., which is now being developed very near the Cabigas property. Preliminary surveys of the Gabigas property indicate the possibility of a large tonnage of high-grade iron ore.

IN AUSTRALIA

Australian exports of crocidolite asbestos are expected to rise to 20,000 tons a year within the next 12 to 18 months. Plans are now being studied to increase the capital investment in the western Australian plant to achieve an exportable surplus of 40,000 tons a year but a decision is unlikely in the near future.

Australian export policy on manganese ore is to be re-examined after the conclusion of the current survey of ore reserves. At present only a proportion of new reserves can be exported, though some 25,000 tons are exported every year. Experts believe that some relaxation of the export policy is imminent.

Australian blister and refined copper production in 1958 was 64,000 tons and 44,000 tons respectively and an upward trend in mine production of copper in 1959 is confidently predicted by government circles. Most of the increase will originate in Asarco-controlled Mt. Isa Mines Ltd. The electrolytic refinery at Townsville, Queensland, will come into operation this year and Australian refining capacity will be adequate to cope with the entire blister copper output.

South Alligator Uranium N.L. reports that erection of its solvent extraction uranium plant at the Rockhole mine is progressing satisfactorily. Production of uranium oxide is scheduled to commence in August 1959.

Prospecting for bauxite deposits in Queensland and Northern Territory continues actively and around 200-million tons of economic-grade bauxite have already been proved around Weipa. The Kimberly coastal area is being examined by a subsidiary of Reynolds Metals. And Darling Ranges in the southwestern part of Western Australia are being examined by Western Mining Corp.

At Cockle Creek, New South Wales, the installation of a furnace for the production of lead and zinc is to proceed on a smaller scale. The revised planning provides for the construction of one furnace only with a probable lead production capacity of about 40,000 tons.

The original plan to erect two zinc blast furnaces, each with a capacity of 23,500 tons a year, at the works of Sulphide Corp. Pty. Ltd. has been modified. Only one sinter plant will be installed, one blast furnace and one acid plant. The zinc plant will produce 38,000 tons of zinc; and, some 40,000 tons of lead. Smelting operations are now expected to commence in the latter part of 1961.

Official Australian estimates, made by the chief mineral economist of the Bureau of Mineral Resources, predict a value increase of about 50% in overseas earnings on Australian mineral exports. This does not include new mineral finds nor does it include the value of exports of uranium.

Main increases are expected in revenue from exports of alumina, copper, lead and zinc with smaller increases in asbestos and coal. The estimates cover the next 10 years. The only minerals on which an actual drop in export revenue is expected are tungsten, ilmemite and rutile.

IN AFRICA

The Coal & Steel Community will make its first investment in iron and manganese ore prospecting, as the result of an agreement signed with the French government's Overseas Mining Authority, Bureau Minier de la France d'Outre Mer.

The CSC will start its prospecting activities in the French African Territories by contributing over $400,000 to a five-year program drawn up by

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Africa *(Continued)*

Bureau Minier and designed to discover new ore deposits. Total cost of the program will be $10-million.

Prospecting, which will be handled by the Bureau Minier, will start immediately in Gabon, Cameroon and the Ivory Coast. Preliminary searches have indicated existence of ore deposits in Tchimanga, Gabon: Kriby, Cameroon: and in Cavally, on the Ivory Coast.

Work has started on a 24 ft dia ventilation shaft at the Nchanga copper mine. It will eventually be put down to 3,000 ft. The utimate capacity will be 1-million cfm which should be sufficient for any future development of the mine.

Exports of uranium oxide from Union sources were valued at £4.5-million ($12.6-million) in December 1958 compared with an output of £4-million ($11.2-million) in December 1957. The total value of uranium oxide shipments during 1958 was £53.2-million ($148,960,000)—an increase of 6½% over the 1957 aggregate.

All the signs point to a record year for the Northern Rhodesian Copperbelt. Production has been boosted so much since the copper miners' strike ended in November (after nearly two months' loss of output) that the mines are earning as much now as the did on the average during 1956 when the metal was at an all time high of £437 ($1,223) a ton.

Figures just issued by the Department of Mines in Northern Rhodesia show that almost £11-million ($30.8-million) worth of minerals—the bulk of it copper—was mined in December, and about £10.3-million worth in January.

This compares with an average of about £10.5-million during 1956. And although the February figures are not yet available, it is confidently expected that they will show a similar value, despite the shorter number of days.

Bancroft is due to start producing again after a year's rest due to flooding. Although Bancroft, with an estimated production of about 50,000 tons a year from the second half of 1959, will only contribute about 50% of the output of the bigger mines like Nchanga and Mufulira, it will still add materially to what may well be the biggest year in the Copperbelt's history.

Two factors are responsible for the dramatic recovery in the territory's ailing fortunes: First, the big leap in the copper price from about £200 a ton six months ago to its present figure of approximately £247; Second, greater efficiency and the gradual development and expansion of most mines.

Average copper production from Northern Rhodesia during 1956 was 32,000 tons a month. Current production figures are 38,000 tons for December and 36,000 tons for January. Later on in the year output may well be averaging over 40,000 tons a month.

The miners' strike which caused a shutdown in the Northern Rhodesian copper mines about the middle of the year, plus a fall in the world copper price, accounted for all but £700,000 of the £19.5-million drop in the yield from all mines in the Rhodesian Federation last year. The total value of all minerals fell to £102,557,000—the lowest level since the Federation was formed—according to provisional figures issued by the Central African Statistical Office.

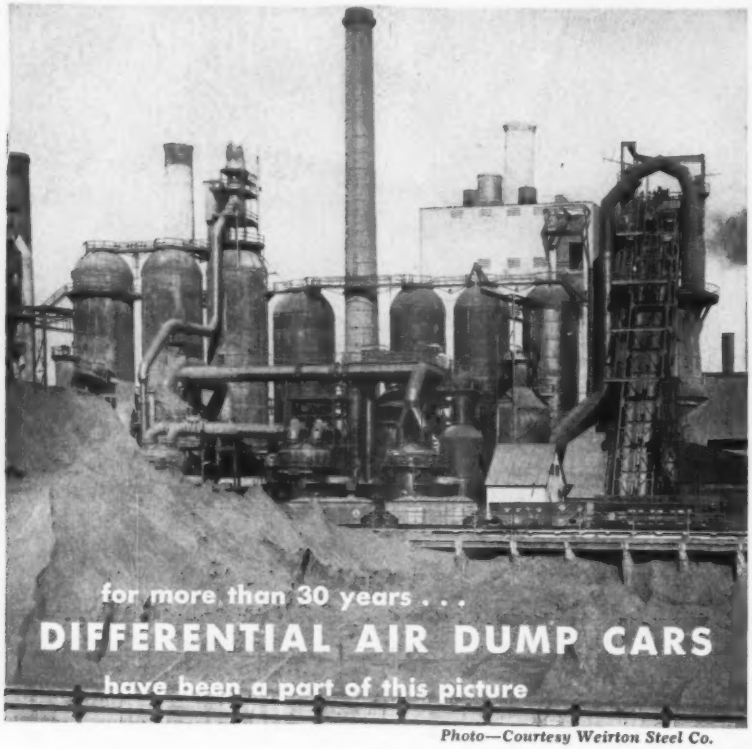
The value of copper produced fell from £18,709,000 to £70,094,000.

Southern Rhodesia's contribution to the Federal total declined only slightly, by 1.5%, to £25,332,000. Gold production in Southern Rhodesia increased by 4.5% to the record value of £6,950,302 last year.

Asbestos remained at the top of the list with £8,593,726, although this was down 4.5% from the 1957 figure. The value of chrome produced dropped 12% to just under £4-million reflecting industrial conditions overseas and, in particular, the fall in steel production in the U.S.

The yield from all mines in Northern Rhodesia dropped from £96,337,000 in 1957 to £77,225,000 last year.

Provisional figures show that apart from copper a fall was recorded in the values from zinc, lead and certain types of cobalt.



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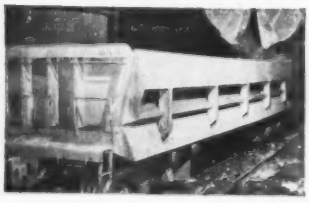

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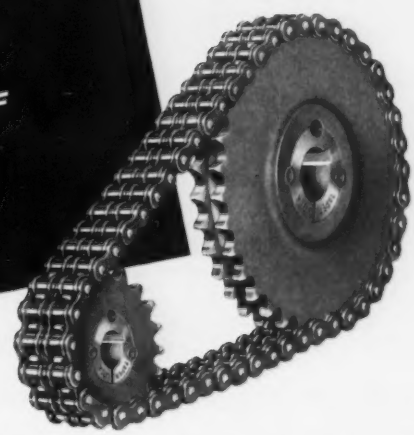

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Africa *(Continued)*

Manganese values, on the other hand, showed a positive trend, rising by nearly £74,000 in the first 10 months of 1958 as compared with the same period of 1957.

ISRAEL

Israel's $16-million copper plant has finally gone into production after a start-up period filled with bottlenecks. The country's first export of copper since King Solomon's days has been shipped abroad to Germany. The shipment of cement copper marks the overcoming of most of the major difficulties that plagued the plant's operations since its start.

Planned annual output is 9,000 tons of cement copper. Copper reserves for at least 15 years are surveyed, with an estimated four times that amount known to exist in the area. The copper content of the ore reaches 5% and averages out at 1½%.

IN EUROPE

The over-all output of the Austrian nonferrous metals industry increased over the 1957 output during 1958, the Federal Ministry of Trade and Reconstruction announced in Vienna.

Item	metric tons	compared to 1957
Aluminum		
Primary	57,114	plus 2%
Secondary	15,152	
Soft lead	8,904	plus 3.1%
Hard lead	2,560	plus 19.6%
Electrolytic copper	9,548	plus 0.5%
Copper alloys	31,039	plus 24.5%
Semi-finished aluminum	24,410	plus 4.4%
Semi-finished lead	3,340	plus 9.0%
Semi-finished zinc	1,277	plus 1.9%

The boost in copper was due to the increased Austrian copper wire production, which rose by 5,000 metric tons to 19,000 metric tons in 1958. The reduction in aluminium semi-finished materials is ascribed to the soft aluminum wire output which decreased sharply.

A new copper processing plant was opened in Sredna Gora, Bulgaria, (about 125 kilometers southeast of Sofia), which is to produce not only electrolytic copper, copper sulphate and sulphuric acid, but also—as East Europe's only plant—gold and silver.

The output of electrolytic copper is to reach 12,600 metric tons by 1962. Bulgaria expects to be able to fulfill all domestic copper requirements by 1960, enabling the country to export copper after that.

The total output from Finland's mines in 1958 was 2.6-million tons, double the total six years earlier. Mines now being planned promise to double the yield again in the next six years.

Finland has five ore mines in produc-

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IN SOUTH KOREA

With the Gulf magnetometer and Mount Sopris scintillation counter in the Apache, AERO's crews are flying at 500 ft. over mountainous Korean terrain. Flight line spacing is one mile. Area: 10,000 square miles. Data will be interpreted in the field at Seoul by AERO's chief geophysicist, with more detailed studies to be carried out in Philadelphia.

IN THAILAND

AERO crews are seeking new deposits of iron ore and radioactive minerals over 4,000 square miles in Thailand. Flights are at quarter mile spacing, at a 500 ft. altitude. Preliminary interpretation of geophysical data is to be done at Bangkok. Data will be analyzed further at AERO's headquarters.

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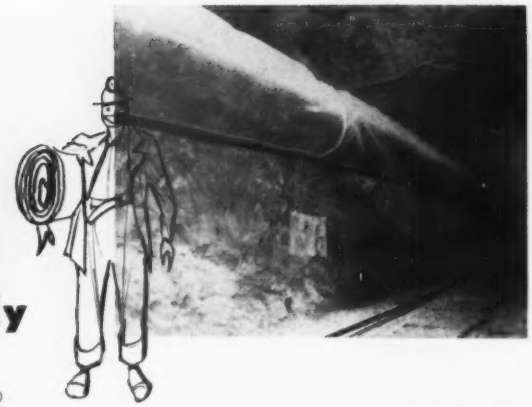

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Europe *(Continued)*

tion now, in 1959 two more will be started: Kotalahti, for nickel and copper, owned by Outokumpu Inc; Karvasvaara, for iron, owned by Otanmaki Inc. Within two years another two should be in production: Korsnas, for lead, owned by Outokumpu Inc; Nyhamn-Jussaro, for iron, owned by Vuoksenniska Inc.

Plans are being prepared and prospecting continues for another three mines. The biggest of these is the much discussed Kolari ore field in northern Finland where the estimated reserve is 44-million tons of iron ore.

Three likely-looking uranium finds have been made—Eno, Askola and Perna. Of these, Eno, owned by Atomienergia Inc, offers excellent prospects. Samples have already been sent to Sweden. The Eno mine could make Finland self-sufficient for uranium supplies at least for a few years.

Herman Stigzelius, chief of the Department of Mining, Ministry of Trade and Industry, says: "The possibilities of developing the Finnish mining industry are greater than the capital resources available." Here are his very rough estimates of what would be needed in the next five years to carry through plans already made.

Ore mining and dressing will take a capital investment of $12.5 to $30-million per year. If processing and iron works are included, the total capital requirement in five years will come to approx. $124- to 186-million." The possibilities of using the long-term credits offered by the USSR (400 to 500 million roubles) to help in the erection of steel works planned in Finland are being investigated," he said.

The building of a new iron and steel works has attracted special attention recently, mostly for political reasons. The capital need for such a works in the north is around $55-million. Finland started shopping for offers in West Germany and England, thus angered the Kremlin which had hoped to get the job. Some Finns are still dickering with the West European countries, but President Kekkonen and the Russians may prevail and let the contract eastward.

A $2.5-million loan by French Petrofigaz will help push French aluminum production up by 80,000 metric tons annually by 1960.

Proceeds will go into construction of thermal power station fueled by natural gas from the Lacq field, near Pau in southwest France, and two electrolytic plants. The power plant will use 106-million cubic ft of refined gas daily and have a total capacity of 500,000 kw. All installations will be located near the Lacq field. Construction started in 1957 and the plants are scheduled to start operating in the first half of 1960.

Aluminum production in metropolitan France reached 169,000 metric tons in 1958. Pechiney, larger of the two French aluminum companies, produced 139,000 tons and Ugine the remaining 30,000. In addition, the Alucam reduction plant in Edea, French Cameroons—in which

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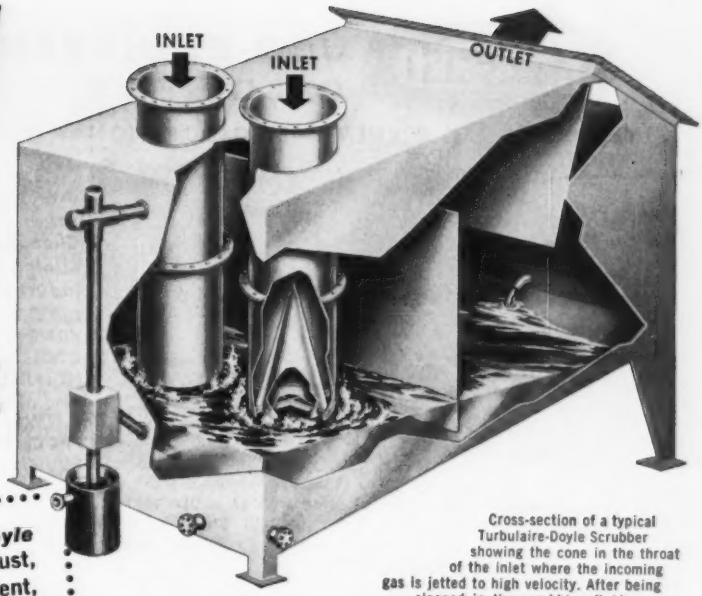

Cross-section of a typical Turbulaire-Doyle Scrubber showing the cone in the throat of the inlet where the incoming gas is jetted to high velocity. After being cleaned in the scrubbing fluid, the gas passes over spray eliminator baffles before it is discharged. Collected material is carried away by the circulating scrubbing liquid—is recovered as a liquid concentrate or slurry.

With addition of the Turbulaire-Doyle Scrubber to its line of advanced dust, fume and fly ash collection equipment, there is no industrial gas cleaning problem that Western Precipitation cannot handle with equipment of its own design. This assures your dust and fume control problem receiving the benefit of the industry's most complete "know-how" in all phases of gas cleaning operations.

The Turbulaire-Doyle Scrubber — a development of The Consolidated Mining and Smelting Company of Canada Limited and widely used in its own diversified operations—is now made available to industry by Western Precipitation Corporation under a license arrangement with Cominco.

Actual plant records, compiled over long periods of service, show the Turbulaire-Doyle Scrubber to be unique among commercially-available scrubbers in the multiple advantages it offers...

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★ *Fine Particle Collection* — including those in the fume range!

★ *Low Liquid-to-Gas Ratio* — only 1 to 5 GPM per 1000 CFM!

★ *Wide Application Flexibility* — readily adaptable to various types of corrosion-resistant materials!

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The Turbulaire-Doyle Scrubber impinges dust-laden gas at high velocity into a bath of scrubbing liquid. The high velocity forces the gas and dust particles to penetrate deeply into the liquid for complete wetting and cleansing. A cone in the gas inlet nozzle, just above the surface of the scrubbing bath, provides the jetting action that assures outstanding performance from this unit. *There are no moving parts, nothing to require frequent maintenance!*

If you have dust or fume control problems where scrubber types of collectors are applicable, it will pay you to investigate the *years-ahead* advantages of the Turbulaire-Doyle Scrubber. Write, wire or phone the Western Precipitation office nearest you for further details.

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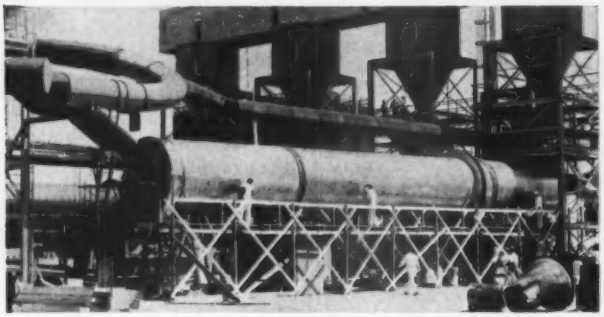

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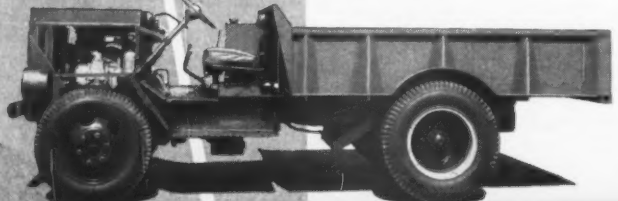

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Europe *(Continued)*

Pechiney and Ugine hold an 89% interest and Belgian Syndicat Belge de l'Aluminum the remaining 11%—produced another 32,000 tons. French share of this 28,000 tons) added to output in metropolitan France, gives total French production of 197,000 metric tons of alumi-

(Continued)

Letters *(Continued)*

tribe and divides the population with about 200,000 on the Burma side. The Wa's are still aloof, and outsiders—either Chinese or Burmese—are unwelcome, so the boundary is maintained only on the maps.

Mining in the Wa area still attracts attention due to its proximity to the Bawdwin mineralized area on the west and the Yunnan mineralized areas on the east. Heavily armed and escorted parties have made short trips into the area and airplanes have been used for general reconnaissance.

The Burma Geologic Department continues to be interested in the area although they report that to date no mine workings of great extent have been examined. A major mining company made a brief examination of a limited area in the early 1930's under heavy military escort. The area examined at that time was reported as "not outstanding".

Perhaps it would be of interest to examine a possible reason for the absence of mines and mining in the Wa territory. The Wa people have been known as head hunters and they still take a head now and again. This alone would not exclude mining. However, the majority of the Was are animists who believe in various "nats" or spirits. It is not uncommon for the poorer people to sell their children to the headman to be kept as slaves or offered to the nats. One of the most important of these nats is the one who dwells in the mountains and for the Was it is unthinkable to disturb this spirit by digging in the mountain.

Approximately 20,000 Wa tribesmen have been converted to Christianity within the relatively short span of 30 years. It is conceivable that, with a further increase in the number of Christians, mining engineers and geologists will be able to examine the Wa state without fear of losing their heads.

D. F. Coolbaugh,
Government Technical Institute,
Isein, Burma

YUGOSLAVIA

Last June, a new lead-zinc mine was put into operation at Kiznica in the Kosovo-Metohija region. Initial production totals 200 tons of high-grade ore daily and, by next spring, capacity will be raised to 500 tpd. Kiznica's deposits contain an estimated 3-million tons of high-grade and 7-million tons of low-grade ore.

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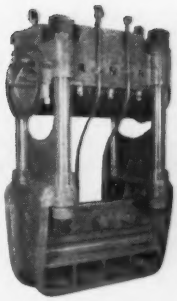

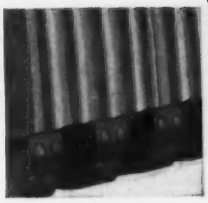

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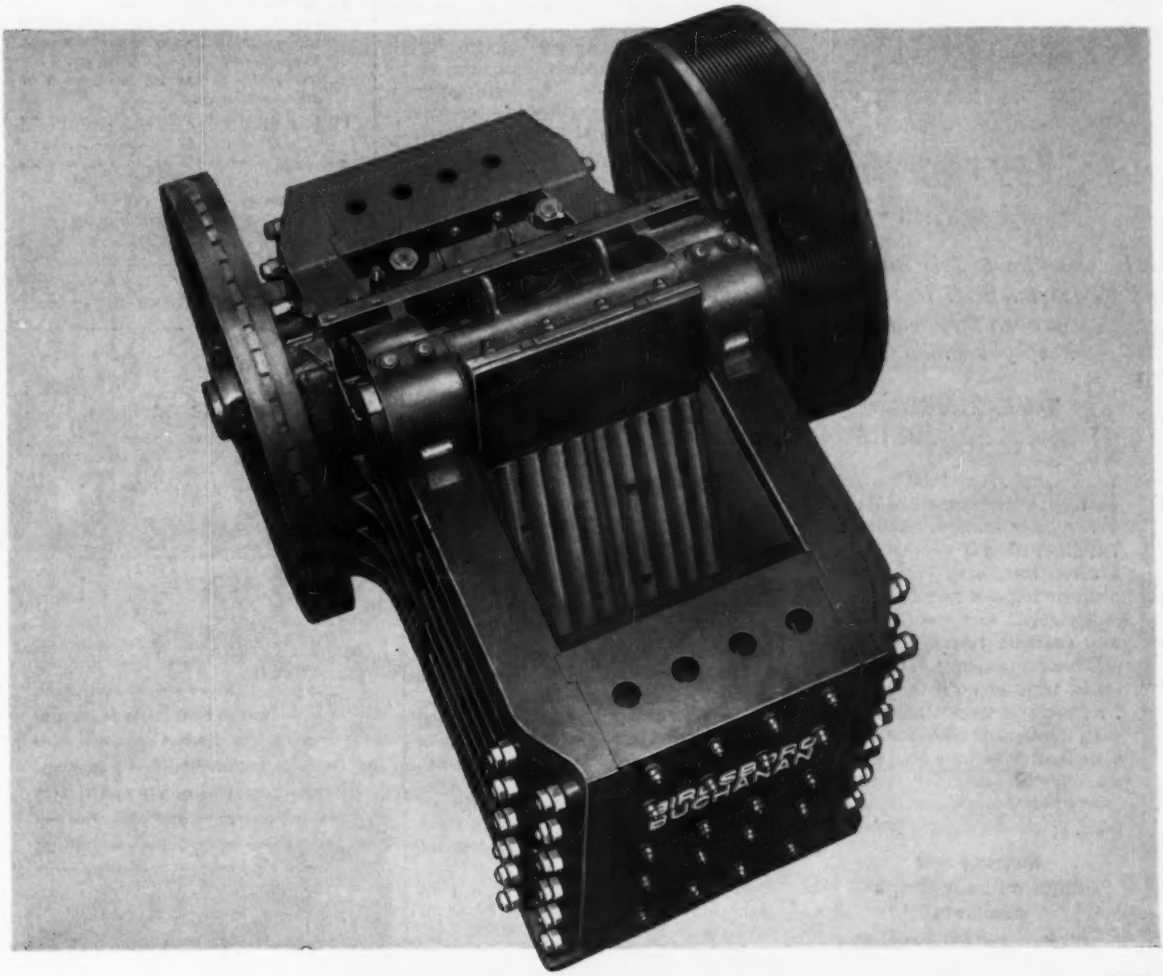

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Europe *(Continued)*

num in 1958, compared to 171,000 in 1957.

When Lacq installations start operating in 1960, French aluminum production—counting 40,000 tons of Alucam metal—will reach 289,000 tons annually.

Lead ore produced in Italy during 1958 equalled 95,000 metric tons as against 88,000 metric tons in 1957, an 8% boost.

Production of lead pigs in 1958 also surpassed that of 1957 by 21.1%. Produced in 1958 were 48,000 metric tons of lead compared to 40,000 metric tons for 1957.

Buxite extracted in 1958 amounted to 299,000 metric tons, 4.4% more than 1957's 261,000 metric tons.

However, production of aluminum pigs decreased from 66,000 metric tons in 1957 to 64,000 tons in 1958, a 3.2% drop.

Mining of non-ferrous ore and processing into concentrates and/or metals has developed during the past 10 years into one of Bulgaria's most thriving branches of industry. The development of the mining industry has been described by various official Bulgarian sources as follows:

	metric tons		
Item	1956	1958	1960 plan
Copper ore.	470,324	702,000	980,000
Lead-zinc ore.....	1,670,687	2,241,000	2,890,000
Lead concentrate.....		101,000	437,800
Zinc concentrate.....		96,000	
Lead.....	6,009	26,070	33,000
Zinc.....	5,838	8,234	44,000

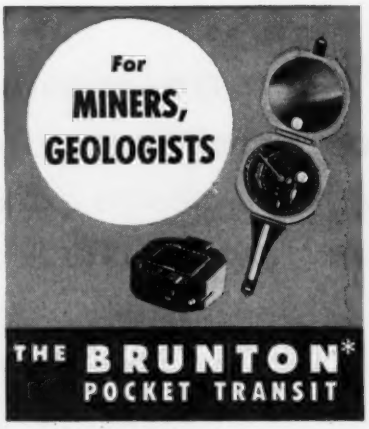
The Bulgarian lead-zinc ore deposits contain 50,000,000 metric tons of ore and 10-million metric tons of copper.

Investments in Bulgaria's nonferrous ore mining and processing industry amounted to 1,028,000 metric tons additional capacity during the first Five-Year Plan (1949 to 1952), and 1,808,000 metric tons additional annual capacity during the Second Five-Year Plan (1953 to 1957).

Starting the second half of 1960—CNRN (Italian National Nuclear Research Committee) announces—Italy will be able to produce 65 metric tons a year of uranium from the uranium ore deposits of the Maritime and Cozie Alps, and 130 metric tons a year of uranium extracted from the deposits of the Trentine Alps starting the second half of 1961.

CNRN also announced that a pilot plant with a daily capacity of 80 kg of uranium is in operation in Milan; and that, by 1965, Italy will have a stock of 350 metric tons of metal uranium, enough to cover natural uranium requirements for Italian nuclear reactors in operation by that time.

On the basis of prospecting and geophysical surveys carried out during the last two years, the regional government of Sardinia has granted three exploration permits for radioactive minerals.



IT'S HANDY...
weighs only 9 oz.; 2¾" x 3" x 1⅛"; easy to carry in pocket, on belt, in car.

IT'S VERSATILE...
ideal for preliminary and supplementary surveying; used as a compass, transit, level, plumb, alidade, clinometer. Shows direction to 1°; level, slope or grade within 1°.

IT'S MADE TO LAST A LIFETIME
"Over 60,000 Brunton Transits since 1896"
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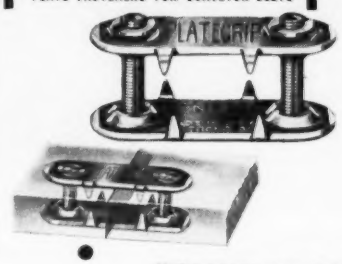
PLATEGRIP
PLATE FASTENERS FOR CONVEYOR BELTS



- **Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from ¼" to 1½" thickness. *Write for Catalog Sheet.***

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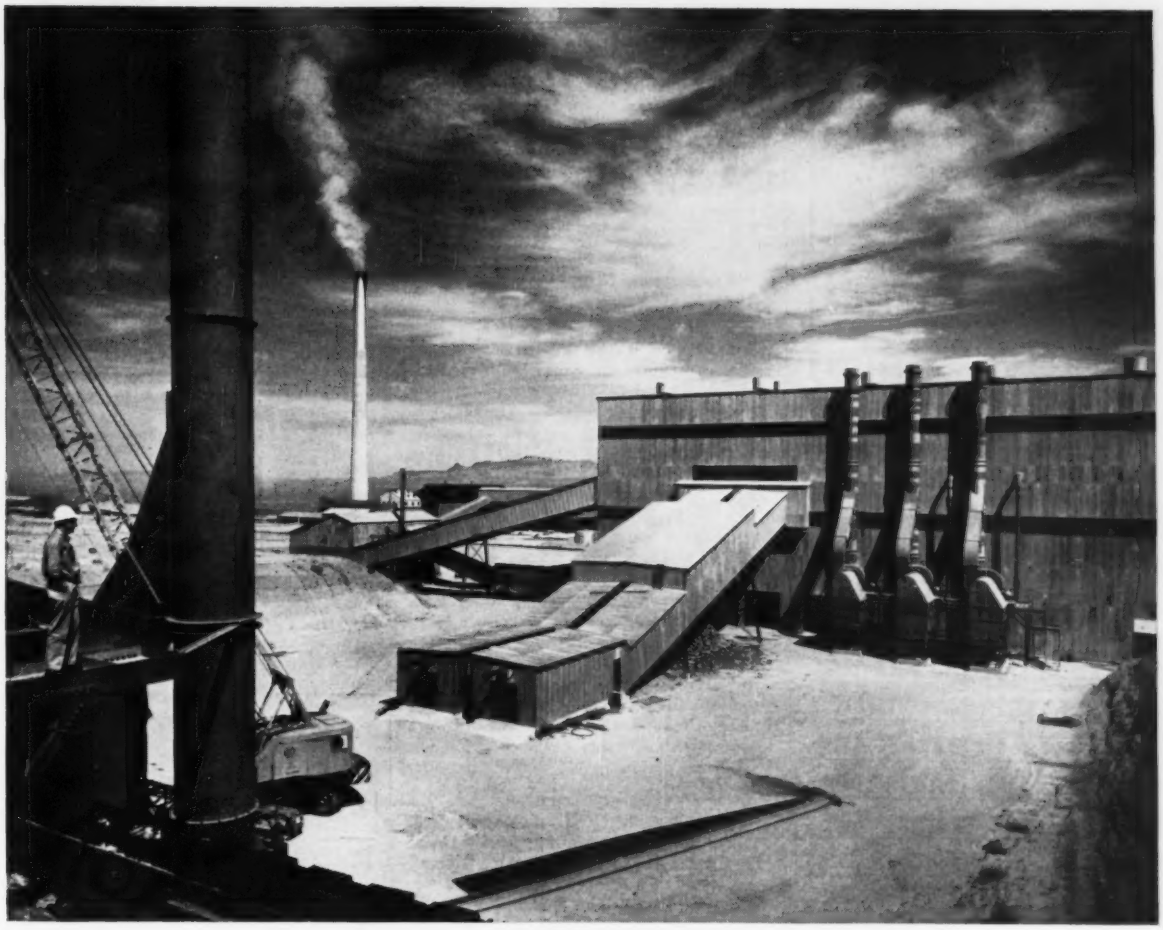

AAF ROTO-CLONES doom dust at this Southwestern copper mill

The only dust you can find around this large copper mill is that kicked up on the surrounding plain. Inside this plant (as in more than a dozen others), dust never has a chance. AAF Type N ROTO-CLONES whisk it away the very second it is created during crushing, screening, transfer and fine ore storage operations.

The high cleaning efficiency of the wet-collecting Type N results from the combined action of centrifugal force and the thorough intermixing of water and dust-laden air. Small space requirement, constant exhaust volume and maintained performance over a wide range of operating conditions—good reasons for specifying the Type N.

For complete product information, call your local American Air Filter representative or write for Bulletin 277. Address: Mr. Robert Moore, American Air Filter Company, Inc., 193 Central Avenue, Louisville 8, Kentucky.

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& Mundo Engineering Co. of Los Angeles, Calif.

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LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

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IN ASIA

A seven-man Japanese steel goodwill mission has left Tokyo to negotiate an eight-million tons Indian iron ore contract under seven-year development scheme. Ore will come—2-million tons from Rourkela mines; 4-million tons from Bailadila; and 2-million tons from Indian Trading Corp. Rourkela mines is now being developed. Japanese steelmakers will invest in the projected development of Bailadila iron mines in the state of Madhya Pradesh. The steel industry began building five 15,000 dead weight ton ore carriers in fiscal 1958 (ending March 31) under joint ownership with shipping companies. In fiscal 1959 five more 18,000 ton ore carriers will be built by individual shipping companies.

U.S. Steel Corp. will be one of the four companies that will exploit the nickel, cobalt and iron which was found in the Dutch colony of New Guinea. Two Dutch mining companies will participate: the East-Borneo Mining Co. and Wm. H. Müller & Co. Furthermore the Dutch bank Nederlandsche Handel Maatschappij (Netherlands Trading Society) will participate.

The nickel ore has been found in the Cycloop Mountains (Vogelkop area) and on the Island of Waigeo, and is of the same composition as the nickel ore found in Cuba (lateritic). It is expected that a smelter will have to be established as the transportation of the ore will be too expensive. The nickel ore assays about 1.6%. It is expected that the work will start during the course of 1959. The deposits contains some 200-million tons of ore.

Following the lead of several Free World zinc producers, the Soviet Union has turned to slag dumps as a means of increasing lead-zinc production. Three slag fuming operations of the same size are to be built in 1959-1960 in Altai, eastern Kazakhstan. Enormous slag piles have accumulated since the mid 19th century, the slag containing more lead-zinc than the richest ores in the region, since these slags were derived from the Demidov mills and smelters which recovered only gold, silver and copper.

One of the major trends in Nikita Krushchev's Seven-Year Plan (1959 to 1965) is the development of the Eastern areas of the USSR in favor of continuing the building-up of the "traditional" heavy industry centers. One of the leading projects is the development of the recently-discovered 6-billion metric tons iron ore deposits in Kustanai province of Siberia.

These deposits, containing high-grade magnetite, are located in Sokolov, Sarbai, Katchar, and Kurshunkul at the "Upper Lake". They are to become the main source of the output increases scheduled for the Seven-Year Plan period. The ores are to be processed in the Sokolov-Sarbai steel center of 19-million metric tons annual charging capacity. The first department is already in operation; the combine is to be enlarged after 1965 to an ultimate capacity of 26-million metric tons annual ore charging capacity.

Kriwoirog is to become the USSR's leading iron ore center by 1965, yielding 90-million metric tons of agglomerated ore per year, or about the same amount which all iron ore plants of the USSR produced during 1958, Tass reported. The South-Ukrainian center is thus to become the leader among the Soviet iron ore producers.

The "Gosplan" administration of the Ukraine claims that iron ore of low metal content will be gained from opencast sites during the next seven years, the cost for the agglomeration of the thus produced ores equal to the high Fe-content ores mined in pits.

The Kriwoirog center will get five new agglomeration plants of a total capacity of more than 35-million metric tons per annum. Parallel to the development of the processing stations, five of the ten planned pits are to be started this year. Changes in the pits involve the lowering of the shafts to between 1,000 to 1,200 meters, or almost double of the currently-worked pits.

The Ukraine possesses in Kriwoirog and three other large deposits more than 33% of all iron ore reserves of the Soviet Union, Tass stated.

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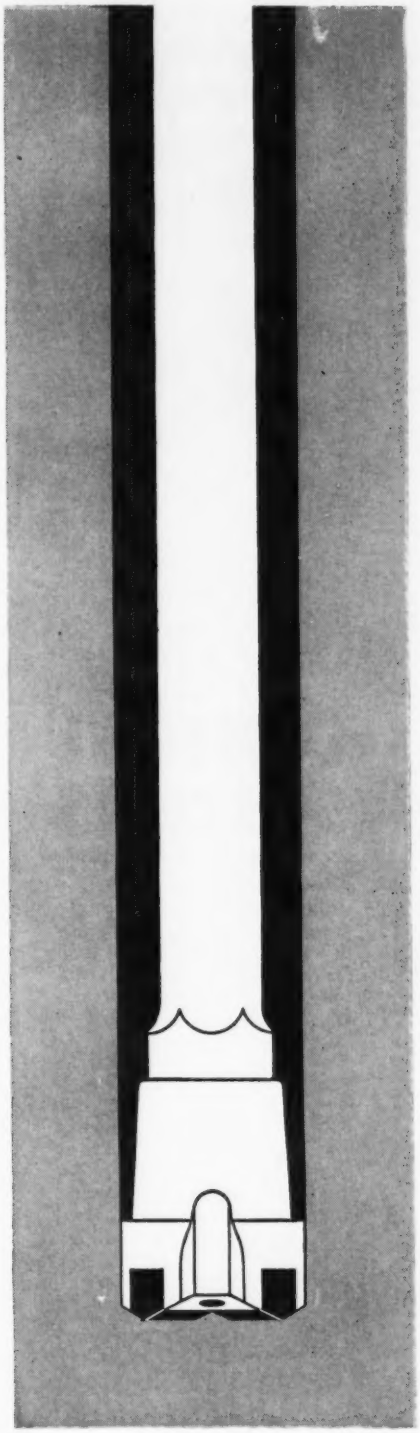

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Here's why . . . Joy bit blanks are precision machined from a fine alloy steel, and a controlled heat treating process adds strength to give rugged service and long life. The carbide insert, a special grade selected for its extra footage-producing ability, is brazed to the bit blank by an exclusive process. This provides a super tough bond between the carbide and the bit blank—there's no lost time due to lost carbides.

These features, plus the excellent chipway design that provides maximum hole cleaning ability, keep Joy bits drilling longer. You get more hole per bit . . . more hole per shift . . . more production.

For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits.

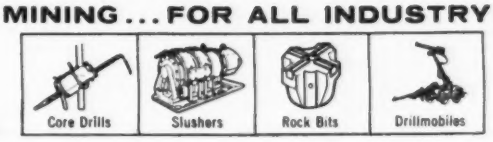
YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"	*2½"	1¼"
1⅝"	*2¾"	1⅜"
1¾"	*3"	1½"
1⅞"	*3¼"	1⅝"
2"	*3½"	1¾"
2⅛"	*4"	
2¼"	*4½"	
2⅜"	*5"	
2½"	†4"	
2¾"	†4½"	
3"	†5½"	
*3½"	†6"	
*4"		
*4½"		

NOTE: * x-type. †Rose design Others are cross type.

Write for Bulletin 294-4

EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY



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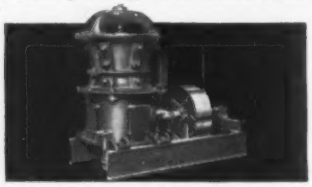
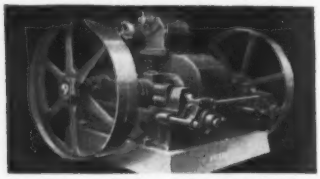
"Open-Door" design gives instant accessibility where needed — makes cleanouts, inspection and maintenance fast and easy. Machines may be set up in units to operate at equal quality and capacity.

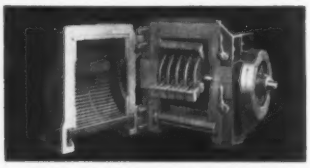
Jaw Crushers — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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PERSONALS

James A. Pike is the new president of the Mining Association of British Columbia. He succeeds **L. T. Postle. E. O. T. Simpson** was elected first vice president, and second vice president is **G. A. Gordon.** Pike has also been made a member of the board of directors of the Canadian Metal Mining Association.

H. E. Doelle, managing director of Sheep Creek Mines Ltd., has been re-elected president of the Chamber of Mines of Eastern B.C.

John N. Ludwig, Jr., has been appointed supervisor of metallurgical services of the International Nickel Co., Inc., according to an announcement by **F. L. laQue,** vice president and manager of the company's development and research division. Mr. Ludwig was formerly associated with the Union Carbide Corp. for 21 years.

John R. O'Connell, Jr., *E&MJ* assistant market editor, has been promoted to associate market editor. He joined *E&MJ* in January 1956 following a short stint of public relations writing in New Jersey. He holds undergraduate degrees from Hampden-Sidney College and Washington & Lee University in Virginia, and will complete work this summer on an MA in the department of American civilization, New York University. His primary duties are with *E&MJ Metal & Mineral Markets.*

O'Connell

Jack W. Still, consulting mining engineer, Prescott, has been named a member of the board of governors for the Arizona Department of Mineral Resources.

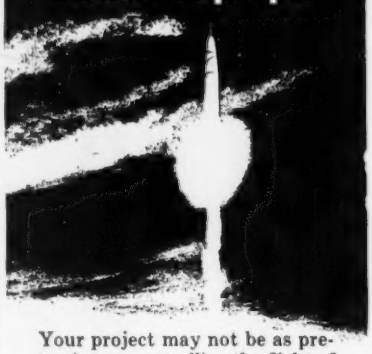
Howard W. Davenport, Minden, La., vice president and director of Woodley Petroleum Co., was elected a director of Pan American Sulphur Co., according to an announcement by president **Harry C. Webb.**

Harry A. Shaw was named assistant to the general manager of the White Pine Copper Co., White Pine, Mich. Shaw was former superintendent at the Garfield electrolytic refinery of the Utah Copper Div., Kennecott Copper Corp.

Douglas Cook, Salt Lake City, senior geologist for Bear Creek Mining Co.'s "coordinating unit", has been named president of the Utah Geological Society. He succeeds **Ray T. Hardy,** an associate professor at Utah State University.

Mel O'Brien has retired as managing director of Bralorne Mines Ltd. but will continue as consulting engineer and as-

For the successful launching of an industrial project



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Personals *(Continued)*

dent of the company and general manager of the Baroid division. Mr. Corddry

Bert C. Austin, San Francisco, has been named to a four-year term on the Cal-

This CP Type ES-2 "Air-Blast" Rock Bit has special tooth structure and spacing to cut drilling costs in formations broken with lime and shale. Available in standard and jet "Air-Blast" types.

This Type ES Jet "Air-Blast" Bit was used by an Indiana strip mine operator to drill over 13,000 feet of 10-5/8" hole in shale and soft limestone. Withdrawn while still making hole, it showed only nominal wear.

even after drilling 13,000 feet in a strip mine this CP "Air-Blast" Bit was still making hole

Miners and quarrymen have found a way to cut the cost of blast hole drilling as much as 35%. They use Chicago Pneumatic "Air-Blast" Bits with rotary drilling instead of percussive drills. They're running holes up to 12-1/4", even in the hardest formations.

For every formation . . . SOFT . . . MEDIUM . . . HARD . . . there's a CP "Air-Blast" Bit just right for the job. With all bit types, CP air blast cleans holes and brings cuttings to the surface, giving every cutter tooth a full, clean bite. Cleans bearings, too.

Get the whole story on CP "Air-Blast" Rock Bits for mines and quarries. Write for your copy of the new Bulletin SP-3224. *Chicago Pneumatic Tool Co., 8 East 44th Street, New York 17, N. Y.*

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Personals *(Continued)*

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Dr. Norbert F. Neumann, employed by the uranium division of Mallinckrodt Chemical Works, Weldon Springs, Missouri, has been selected to receive the Robert Lansing Hardy gold medal of the AIME for 1959. The award recognizes special promise rather than achievement in the field of metallurgy, and is given to a metallurgist who has not reached his 30th birthday before the end of the year during which the selection is made.

George B. Coale and **Graham W. Corddry** have become directors of the National Lead Co. They succeed **George L. Ratcliffe** and **Leonard T. Beale,** who have resigned. Mr. Coale is a vice president of the company and general manager of the Baroid division. Mr. Corddry is manager of the company's titanium division.

Caven

Myers

Hubbard S. Caven and **A. Nelson Myers** have become vice presidents of Texas Gulf Sulphur Co.

Before joining the company in 1947, Mr. Caven was a member of a law firm at Marshall, Texas. He served as a member of the house of representatives of the Texas legislature from 1931 through 1934.

Mr. Myers is manager of sales and operates from the New York office. He joined Texas Gulf Suplhur as assistant sales manager in 1946. From 1940 to 1946, he was vice president in charge of sales for Chilean Nitrate Sales Corp.

Robert E. Mayer is the new chief design engineer for western divisions, Kennecott Copper Corp., Salt Lake City. Prior to joining KCC, Mayer was chief design engineer for F. H. McGraw Co., N.Y.

Bert C. Austin, San Francisco, has been named to a four-year term on the California State Mining Board.

J. Carlton Ward, Jr., president of Vitro Corp. of America, has been elected chairman of the board of Heavy Minerals Co., Chattanooga, Tenn. He replaces **Neele E. Stearns,** president of Crane Co., Chicago, Ill.

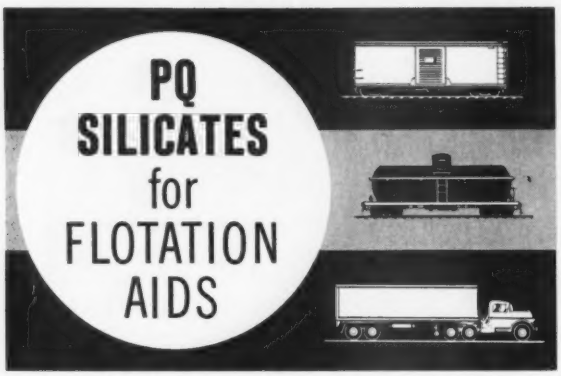
Max M. Blackham has become supervisor of industrial relations at the Garfield Electrolytic refinery of Utah Copper Div., Kennecott Copper Corp.

Dr. Charles E. Reed has been named general manager of General Electric Co.'s metallurgical products department in Detroit, according to **R. L. Gibson,** vice president and general manager of the chemical and metallurgical division.

He succeeds **Kenneth R. Beardslee** who becomes a consultant for the department.

The election of **J. Peter Grace, R. Stuart Keefer** and **Clifton W. Phalen** as directors of the Kennecott Copper Corp. has been announced by **Charles R. Cox,** president. The new members fill vacancies created by the retirement of **Henry S. Drinker, Henry O. Havemayer** and **Alfred P. Sloan Jr.**

Mr. Grace is president of W. R. Grace & Co., international shipping, banking and manufacturing concern. Mr. Keefer is president of the Okonite Co., Kennecott Copper wire and cable fabricating subsidiary. Mr. Phalen recent-



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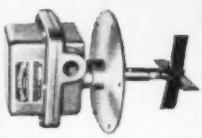

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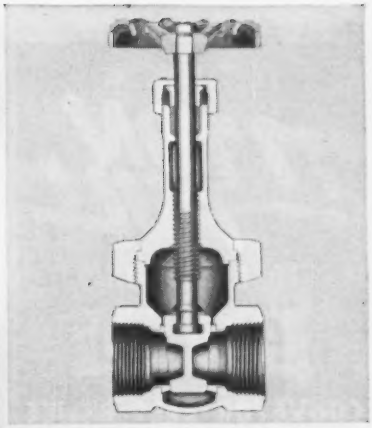

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Before joining the company in 1947, Mr. Caven was a member of a law firm at Marshall, Texas. He served as a member of the house of representatives of the Texas legislature from 1931 through 1934.

Mr. Myers is manager of sales and operates from the New York office. He joined Texas Gulf Suplhur as assistant sales manager in 1946. From 1940 to 1946, he was vice president in charge of sales for Chilean Nitrate Sales Corp.

Robert E. Mayer is the new chief design engineer for western divisions, Kennecott Copper Corp., Salt Lake City. Prior to joining KCC, Mayer was chief design engineer for F. H. McGraw Co., N.Y.

Bert C. Austin, San Francisco, has been named to a four-year term on the California State Mining Board.

J. Carlton Ward, Jr., president of Vitro Corp. of America, has been elected chairman of the board of Heavy Minerals Co., Chattanooga, Tenn. He replaces **Neele E. Stearns,** president of Crane Co., Chicago, Ill.

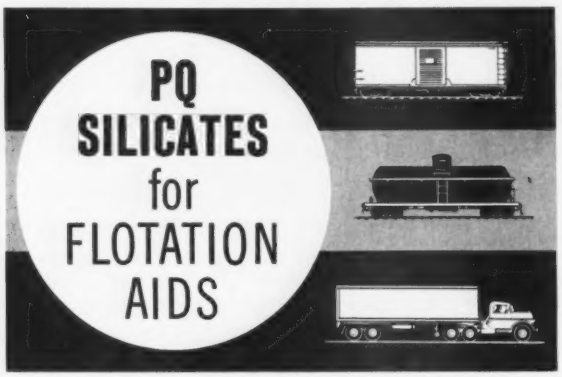
Max M. Blackham has become supervisor of industrial relations at the Garfield Electrolytic refinery of Utah Copper Div., Kennecott Copper Corp.

Dr. Charles E. Reed has been named general manager of General Electric Co.'s metallurgical products department in Detroit, according to **R. L. Gibson,** vice president and general manager of the chemical and metallurgical division.

He succeeds **Kenneth R. Beardslee** who becomes a consultant for the department.

The election of **J. Peter Grace, R. Stuart Keefer** and **Clifton W. Phalen** as directors of the Kennecott Copper Corp. has been announced by **Charles R. Cox,** president. The new members fill vacancies created by the retirement of **Henry S. Drinker, Henry O. Havemayer** and **Alfred P. Sloan Jr.**

Mr. Grace is president of W. R. Grace & Co., international shipping, banking and manufacturing concern. Mr. Keefer is president of the Okonite Co., Kennecott Copper wire and cable fabricating subsidiary. Mr. Phalen recent-



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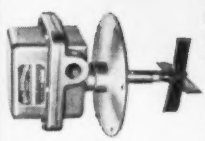

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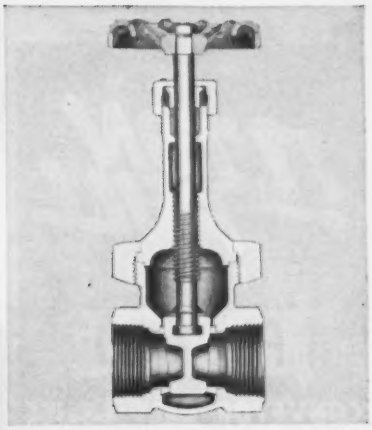

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Personals *(Continued)*

John R. Rand, state geologist of Maine since early in 1956, will end his contract with the state on June 30 to return to private practice in geologic consulting. Mr. Rand, Maine's first full-time state geologist and secretary of the Maine Mining Bureau, has been working to establish the state geological survey as a centralized information agency on Maine Geology, and to re-writing the state mining laws for practicable operation. He is a director of Copper Range Co., White Pine Copper Co., and Big Sandy Co. (coal), and will locate his consulting office in Augusta, Maine.

Rand

OBITUARIES

Morris J. Elsing, mining engineer, died Feb. 27 at Phoenix, Arizona. He was 76.

Mr. Elsing graduated from Columbia University School of Mines in 1907 and that same year became chief geologist for Phelps Dodge Corp. Copper Queen mine, Bisbee, Arizona. He also served as chief geologist for Cananea Consolidated Copper Co., Cananea, Mexico.

During World War II, Mr. Elsing was with the Mining Division of the War Procurement Board in Washington, D. C.

Elsing later became consultant to the U. S. Bureau of Mines at the University of Arizona He was the author of many articles in *E&MJ*, and was co-author of the Arizona Metal Production Bulletin published by the University of Arizona.

Dr. Marcel Ballay, president and managing director of Centre d'Information du Nickel, S. A. (France), an affiliate of the International Nickel Co., died in Paris on Feb. 2 after a brief illness. He was 65. Dr. Ballay had been associated with Centre d'Information since 1928. He was elected vice president in 1950 and president in April 1954.

Howard H. Utley, 84, mining engineer, died at Baxter Springs, Kansas, an Feb. 15. He was manager of the Tri-State District operations of the St. Louis Smelting & Refining Co. Div , National Lead Co. until his retirement ten years ago.

George W. Snyder, 67, president of Snyder Mines, Inc. and W. F. Snyder & Sons Mining Co , died Feb. 18 at Salt Lake City. He played a major role in the development and operation of several Utah and Nevada mining properties, including those of Combined Metals Reduction Co., Bristol Silver Mines, Black Metal Co. and Bluestone Lime & Quartz.

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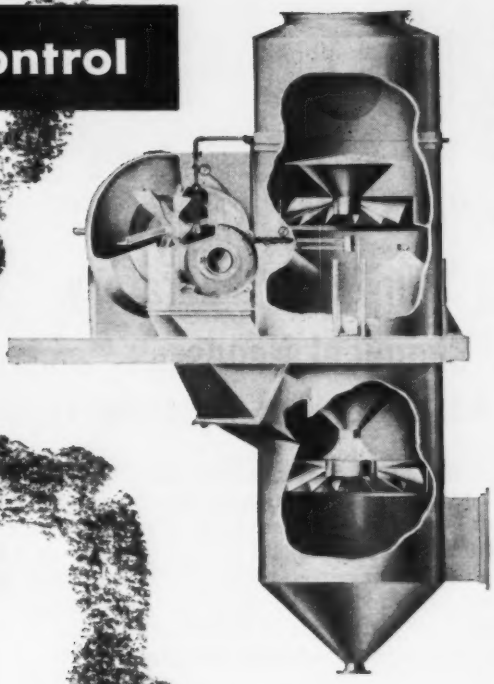

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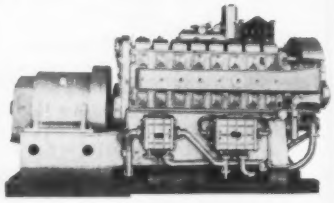

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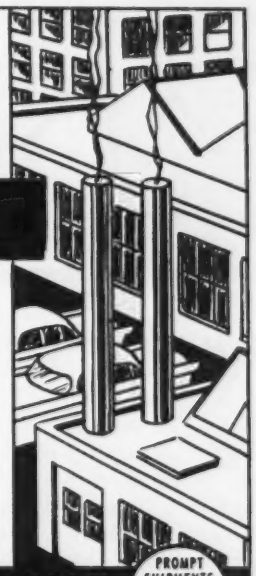

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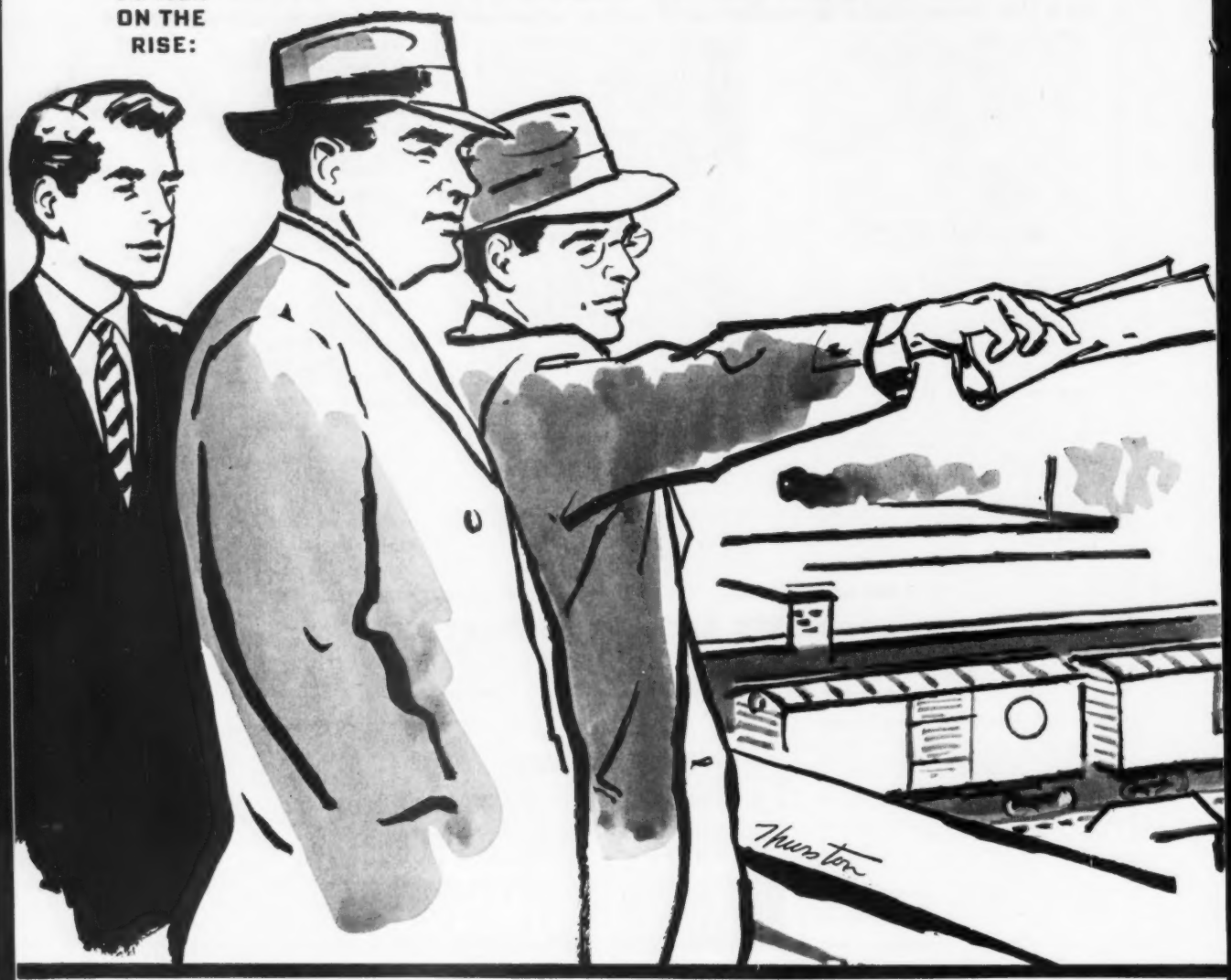

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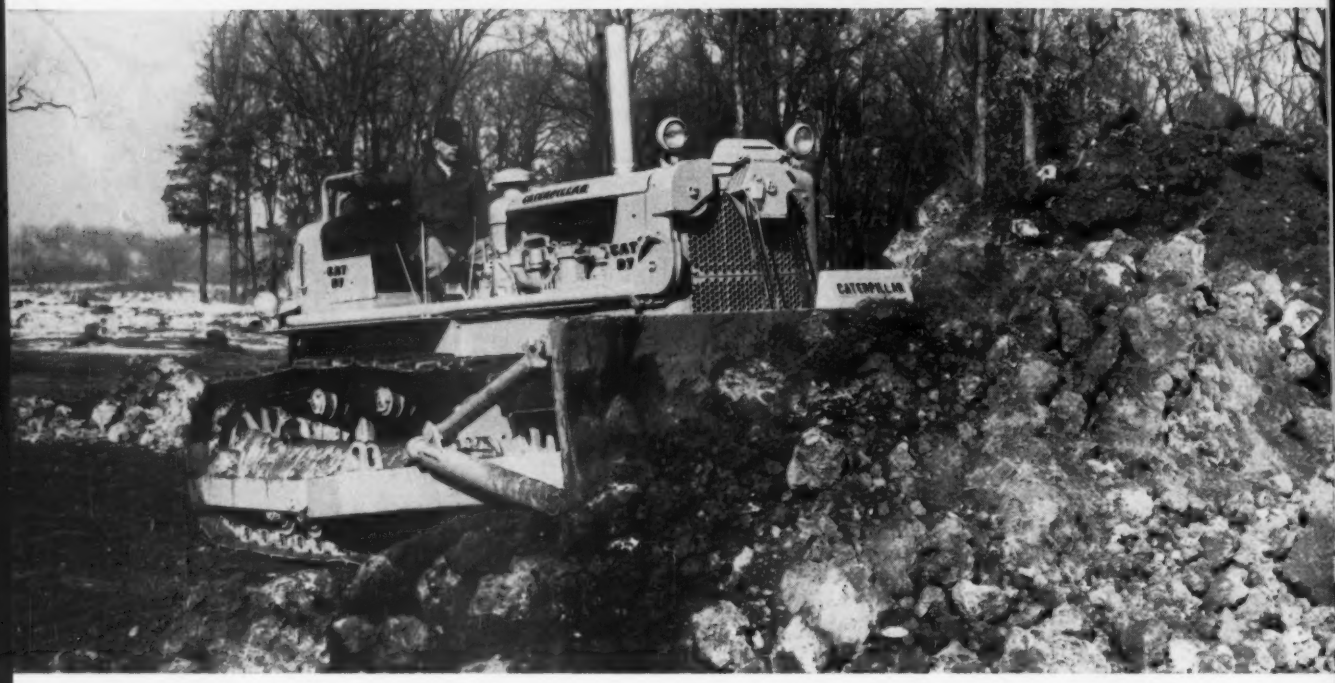

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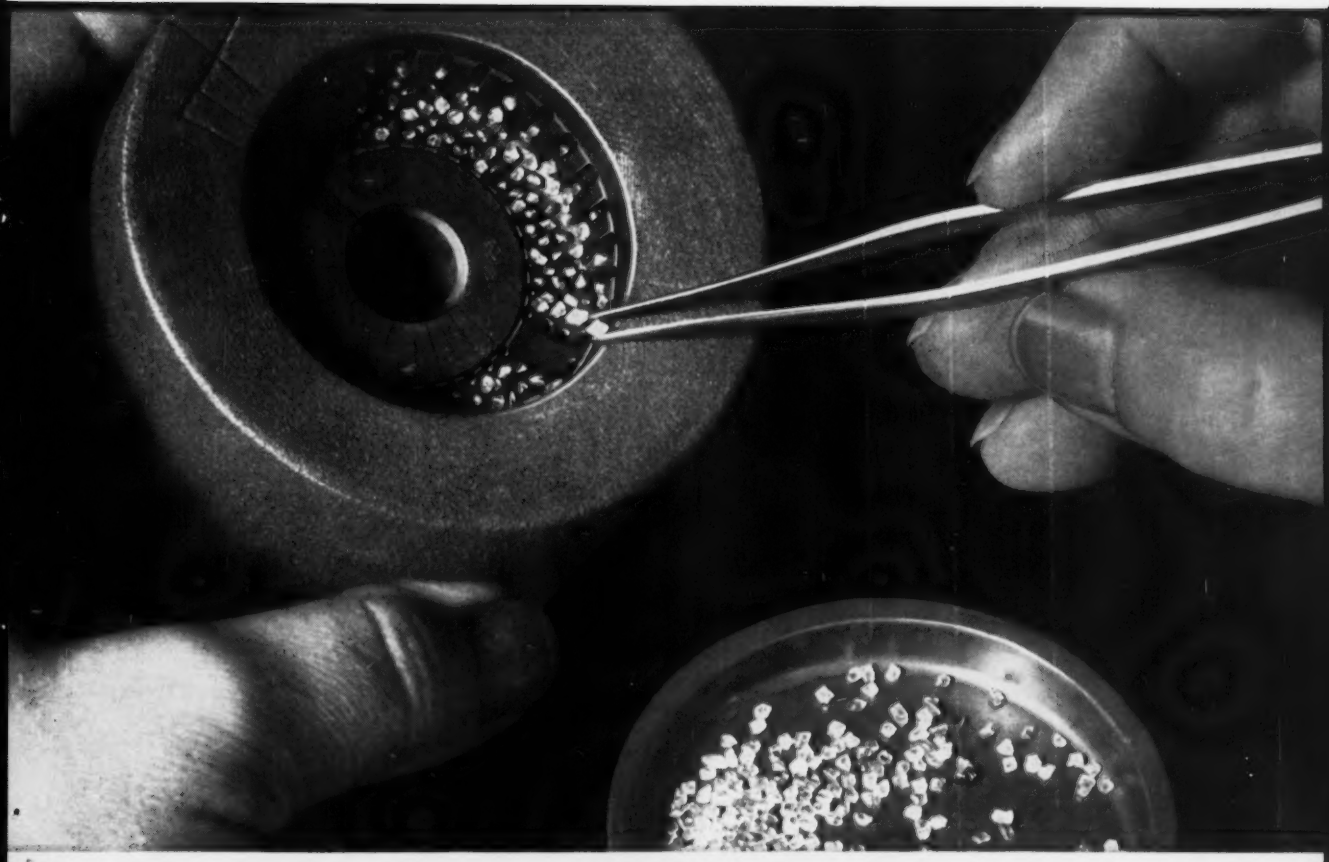

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This diamond business sure is different! Here you see a shot of the operation known as "mechanical setting". Of course, the setter is setting the diamonds *by hand;* they *must* be set by hand because no machine yet devised has the ability to set diamonds with the "best face to the work" that gives you the better cutting power, longer cutting life and greater footage that you want.

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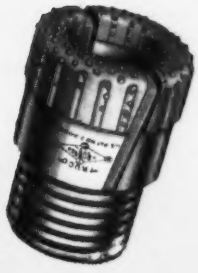

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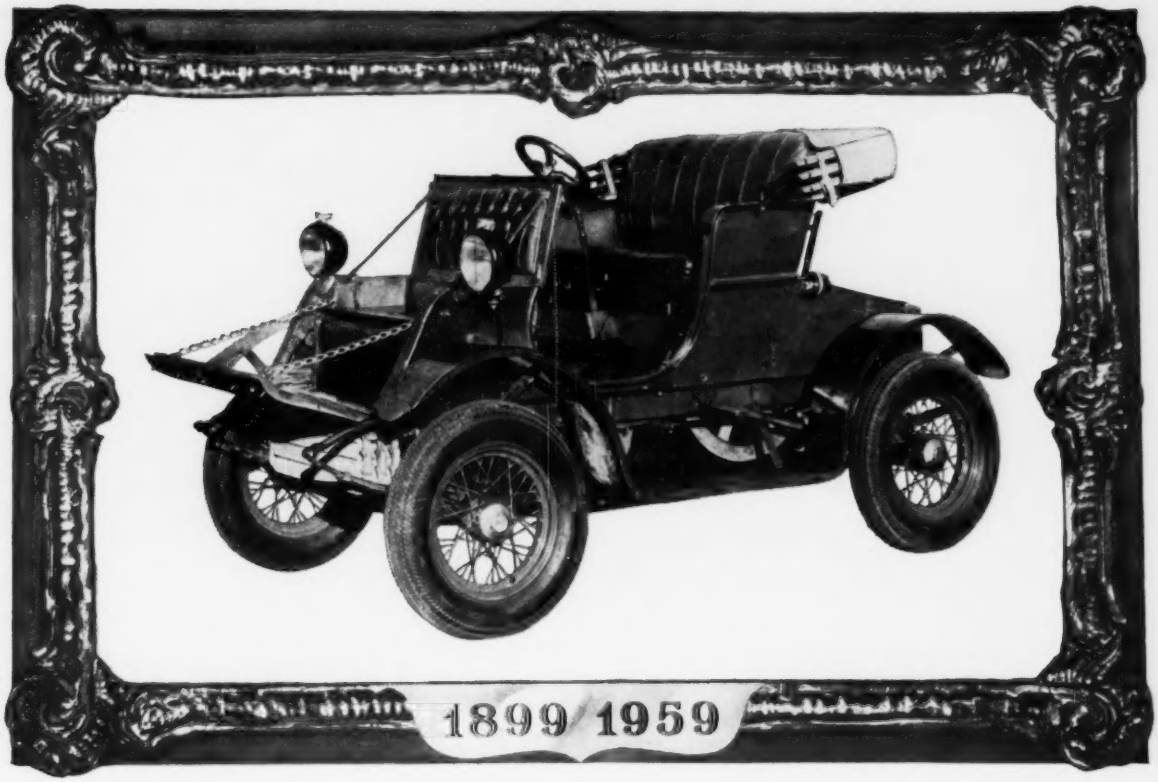

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